Bank Conditions and Recession Along the U.S. Shorelines of the St. Marys, St. Clair, Detroit and St. Lawrence Rivers:
Ancillary Data

Lawrence W. Gatto Earth Sciences Branch



February 1982

Prepared for the U.S. Army Engineer District, Detroit

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This Internal Report contains data and photographs collected CRREL Report 82-11. The data alysis of bank conditions and Detroit, and St. Lawrence Rive	to characterize are presented by recession along	the bank co river to co the shorelin 1977 to 198	enditions and onform to the second the secon	nd chang he CRREL St. Mary	es reported in report. The an-
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The analysis of bank conditions and recession along the shorelines of the St. Marys, St. Clair, Detroit and St. Lawrence Rivers was done from 1977 to 1980 (Fig. 1). As part of that analysis, a large volume of detailed, site-specific field data and photographs were collected to characterize the bank conditions and changes reported in CRREL Report 82-11. This Internal report contains that information. The data are presented by river to conform to the CRREL Report. This Internal report does not contain analysis of these data.

During the initial boat survey of the Detroit River, the shoreline of Lake St. Clair (Fig. 2) was observed from Grosse Point Yacht Club to Windmill Point. This shoreline was protected with various types of structures, primarily bulkheads or seawalls. The remainder of the U.S. portion of the lakeshore is greater than three miles away from the navigation channel, well beyond the zone influenced by passing ships (Tomandl, pers. comm. 1977). Consequently, none of the Lake St. Clair shoreline was monitored during the later boat surveys.

Bank soils maps adapted from the Soil Conservation Service (SCS) soil surveys were prepared for the Marys and St. Clair Rivers (Fig. 3) to provide additional data on bank composition. I did not prepare soils maps for the Detroit or St. Lawrence Rivers. The soil series have not been mapped for Wayne County along the Detroit River (Fig. 3). The SCS mapped only the four regional soil associations for a reconnaissance soil survey. The reconnaissance survey map is too general to provide useful information on bank soil characteristics along the Detroit River.

At the time of this project, soil series information was available only for Franklin County and most of St. Lawrence County along the St.

Lawrence River; the SCS had not completed the mapping for Jefferson County. For soils information along the St. Lawrence River, the St. Lawrence-Eastern Ontario Commission (1977) discussed bank erosion potential using soils data and provided a good inventory of shoreline structures and an estimate of the amount of receding bankline along the St. Lawrence River.

I desc. bed beach characteristics, bank composition, evidence for bank erosion due to surface runoff or groundwater seepage, land use, and upstream, downstream and nearshore conditions along reaches with eroding banks that were representative of the eroding banks along each river. I also prepared river cross sections for the eroding reaches that are representative of the general river bottom topography between the reaches and the navigation channel. These cross sections were drawn from and the distances to the channel were measured on navigation charts and topographic maps.

Reference

St. Lawrence - Eastern Ontario Commission (1977) Evaluation of shore structures and shore erodibility, St. Lawrence River, New York State. Contract report prepared for the St. Lawrence Seaway Development Corporation, Massena, New York.

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Project review and coordination meetings	7 7	4	-							
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St. Clair/Detroit Rivers (1 Feb 77)	V					-				
St. Lawrence River (_Oct 77)		4							_	<u> </u>
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St. Clair River	15/23		_	3/20	1 (20,3)	-	10/1	1/4.	1	12/2
Detroit River	15/3,34	-	4	15/21	0E/1/V	T	30	<i>a</i> ▼	1/3	5/20
St. Lawrence River		<i>1,</i> ▼	,	5/16	6. V			97.	21.	
Acquire large-scale (1:5,000) aerial photography										
St. Marys River		<u> </u>	6/	20	~	88	à		\vdash]
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Detroit River		▼	%	1/33	`.▼	12/2	23			
St. Lawrence River		1	▼ ///	1/21	14	1/22 1	5/3			
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2 =										
3 = Apr-Jun 4 = July-Sept										

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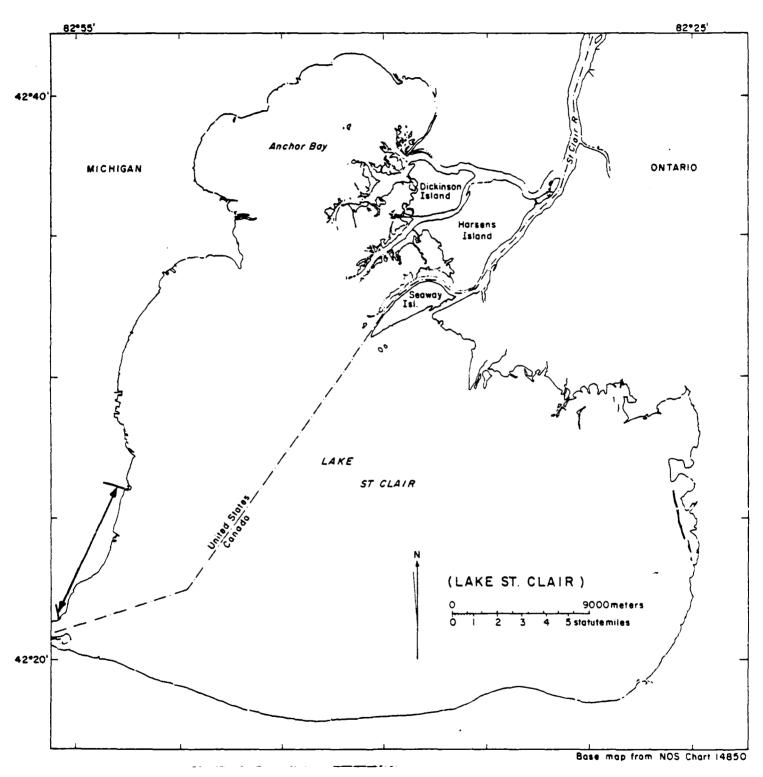


Figure 2. Surveyed portion of Lake St. Clair

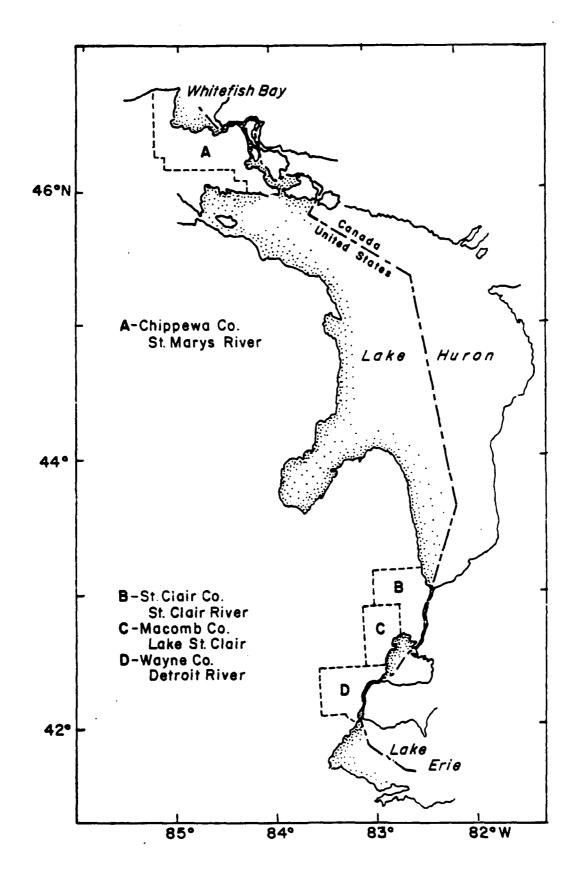
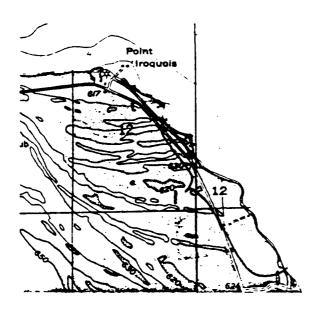
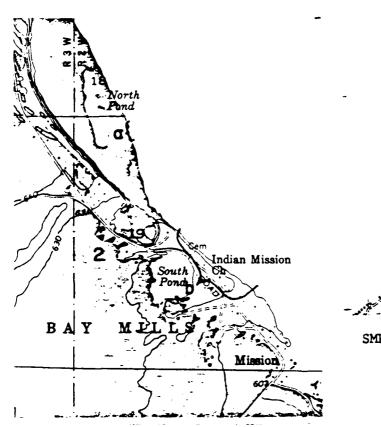


Figure 3. County locations of soil surveys.

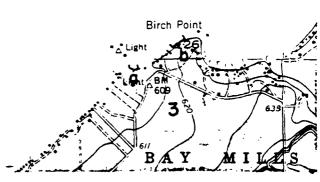
Locations of partially vegetated and bare banks (shown on portions of U.S.G.S. 7-1/2 minute-series topographic maps).



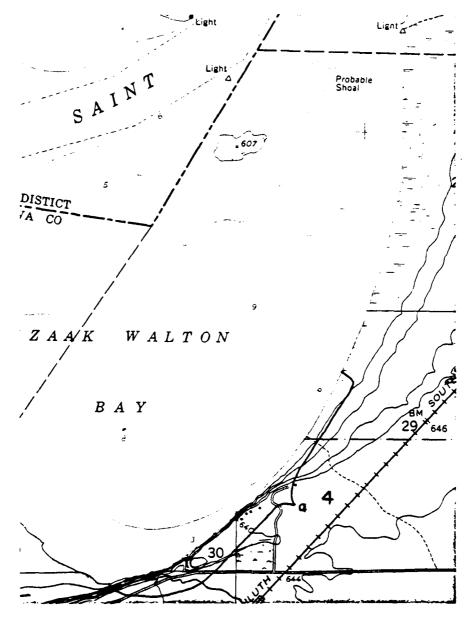
SMR site 1 (Dollar Settlement, Mich., 1951, and Brimley, Mich., 1975)



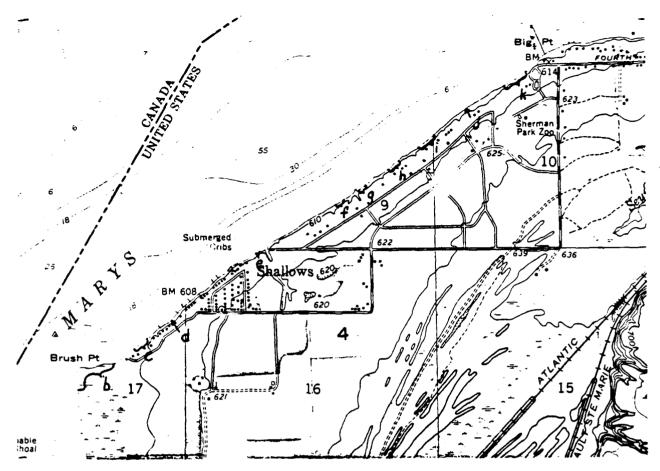
SMR site 2 (Brimley, Mich., 1975)



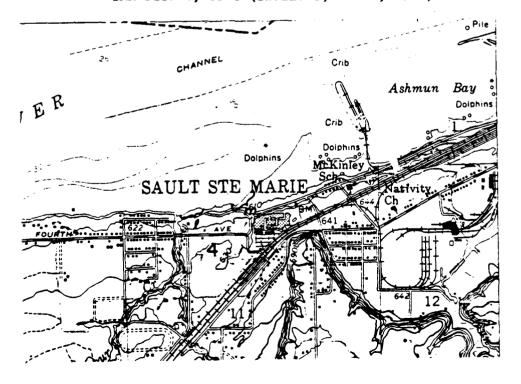
SMR site 3 (Brimley, Mich., 1975)

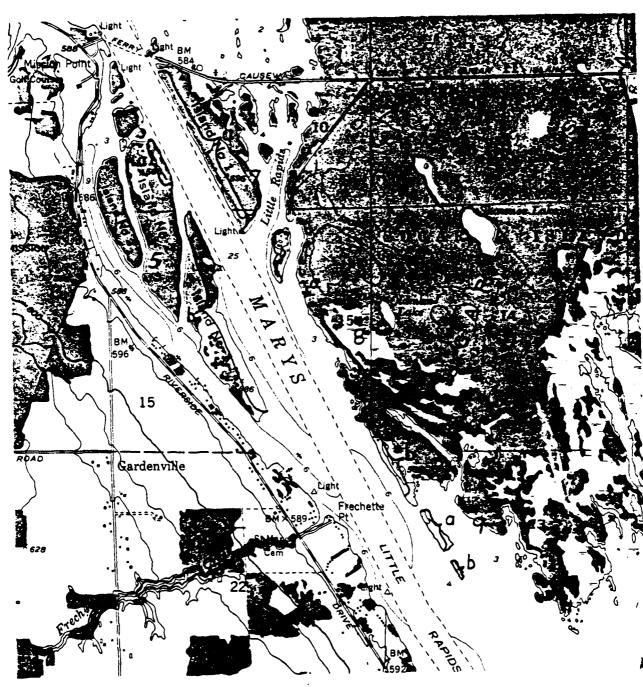


SMR site 4, west (Shallows, Mich., 1951)

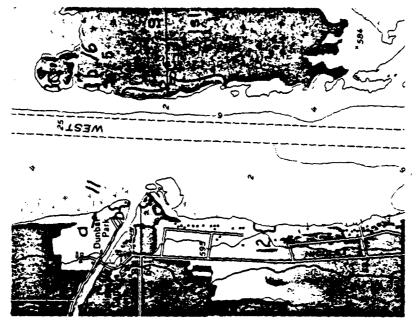


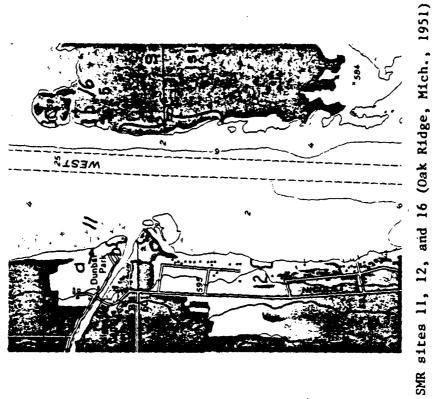
SMR site 4, east (Shallows, Mich., 1951)



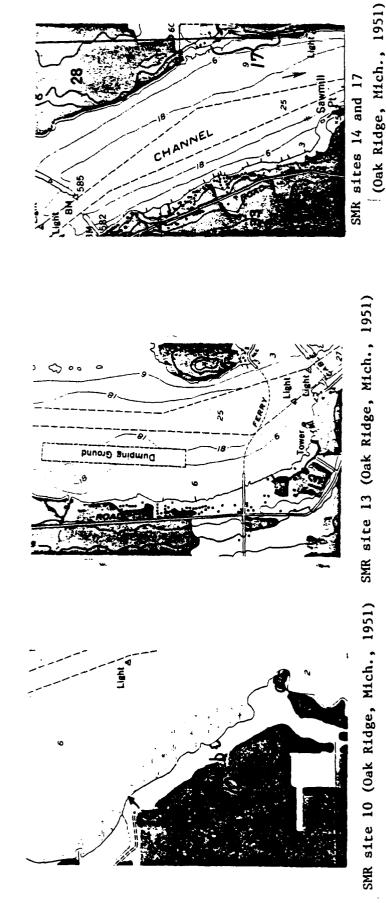


SMR sites 5, 7, 8, and 9 (Sault Ste. Marie South, Mich., 1951)

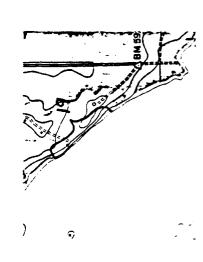




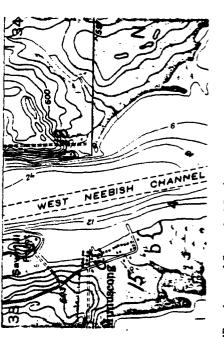
SMR site 6 (Sault Ste. Marie South, Mich., 1951)



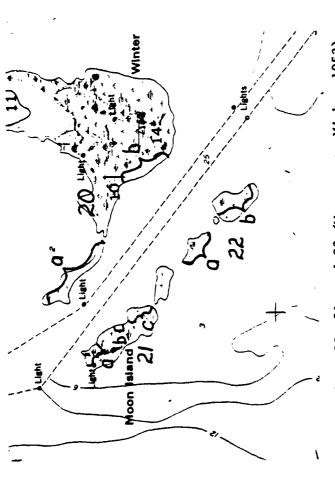




SMR site 19 (Munusches, Mich., 1953)



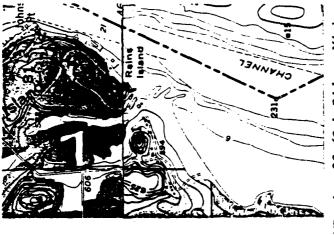
SMR sites 15 and 18 (Munuscong, Mich., 1953)



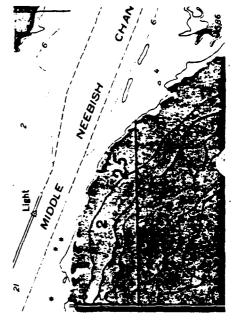
SMR sites 20, 21, and 22 (Munuscong, Mich., 1953)



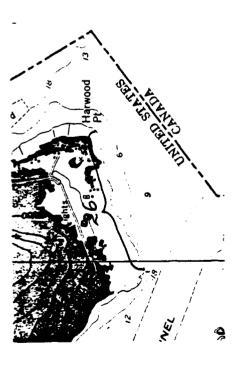
SMR site 24 (Oak Ridge, Mich., 1951)



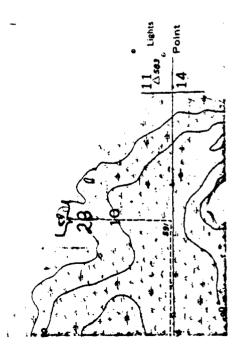
SMR site 23 (Oak Ridge, Mich., 1951, and Munuscong NE, Mich., 1953)



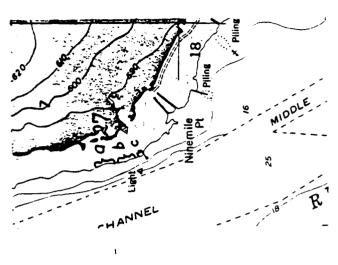
SMR site 25 (Oak) . ge, Mich., 1951)



SMR site 26 (Oak Ridge, Mich., 1951)

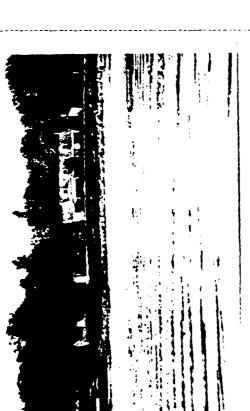


SMR site 28 (Munuscong NE, Mich., 1953)

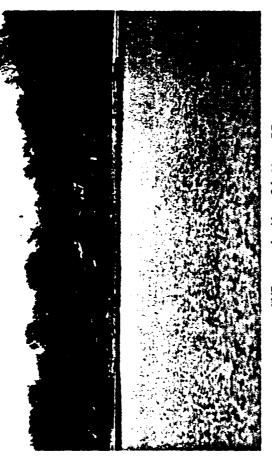


SMR site 27 (Baie De Wasai, Mich., 1951)

Selected photographs that illustrate the diversity of the eroding banks; not all eroding banks are shown.



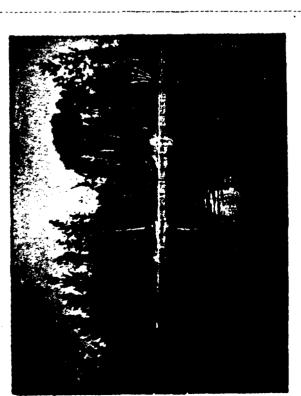
Sift reach 41,26 May 77



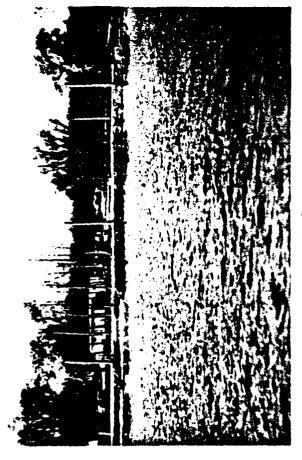
SMR reach 4k, 26 May 77



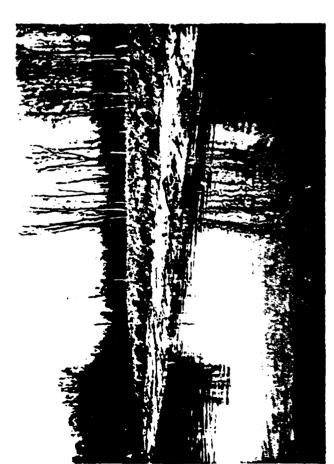
Siff reach 5a, 2 Nov 78



... SMR reach 5b, 25 May 77



SMR reach 6a, 20 Oct 77



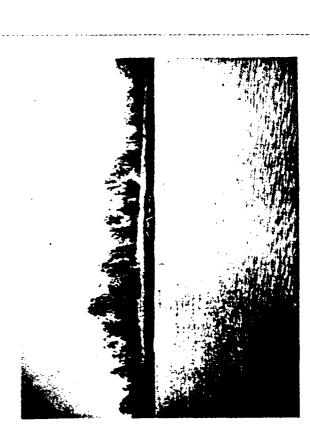
Stiff reach 6c, 23 May 78



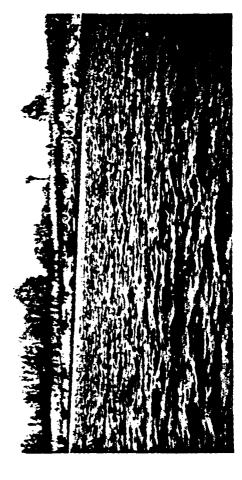
SMR reach 7a, 25 May 77



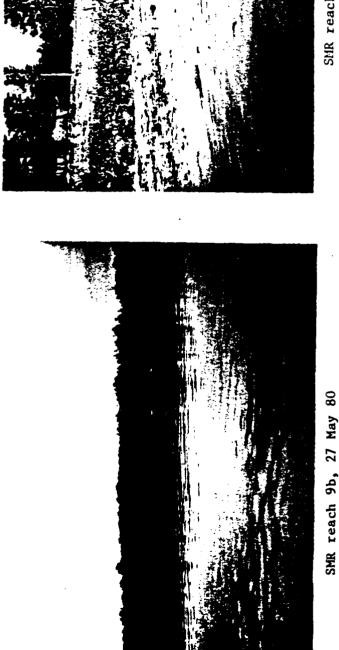
SMR reach 7b, 25 May 77



SMR reach 8b, 25 May 77



SMR reach 9a, 20 Oct 77



SMR reach 11b, 22 May 78



SMR reach 11b, 22 May 78

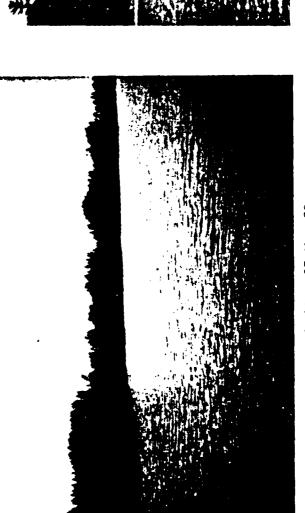




SMR reach 16a, 2 Nov 78

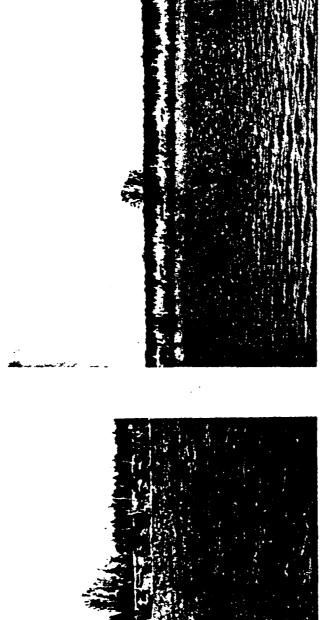


SMR reach 16b, 2 Nov 78



21

SMR reach 21b, 25 May 77



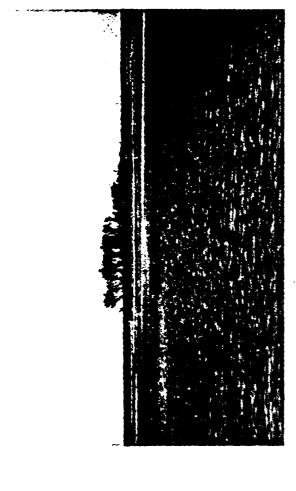
SMR reach 20a, 25 May 77



SMR reach 21a, 27 May 80

SMR site 19, 20 Oct 77

Slik reach 24b, 2 Nov 78



SMR reach 22a, 25 May 77



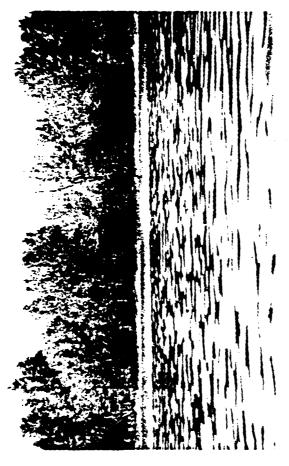




23



SMR reach 24b, 2 Nov 78



SMR site 25, 25 May 77



24

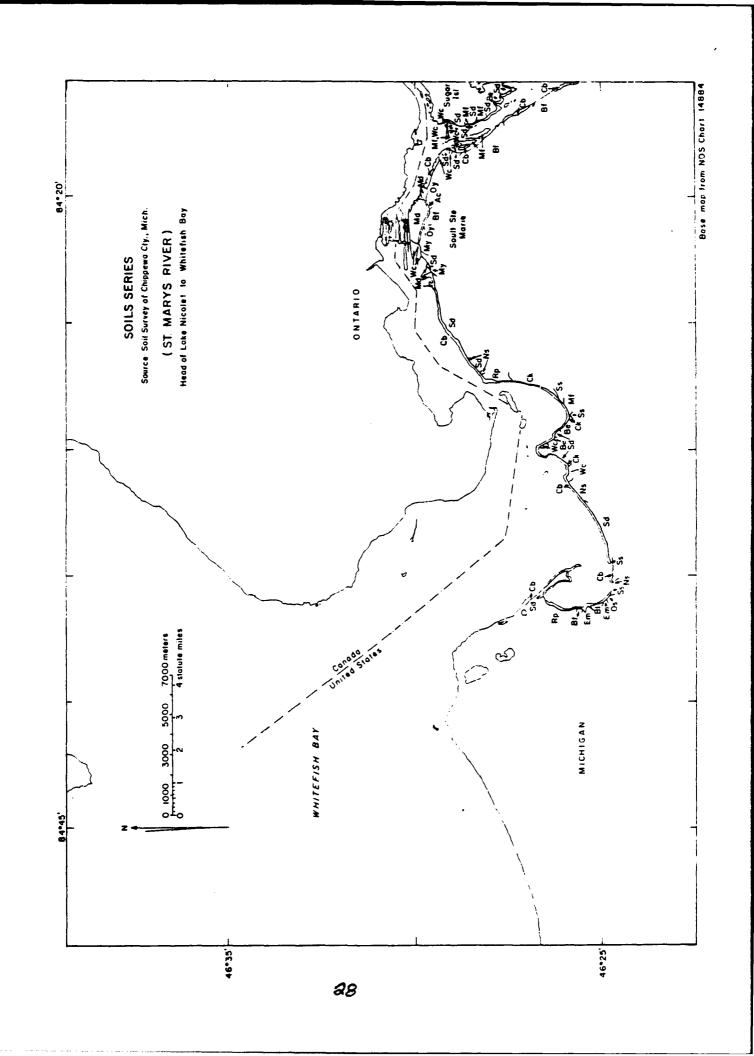


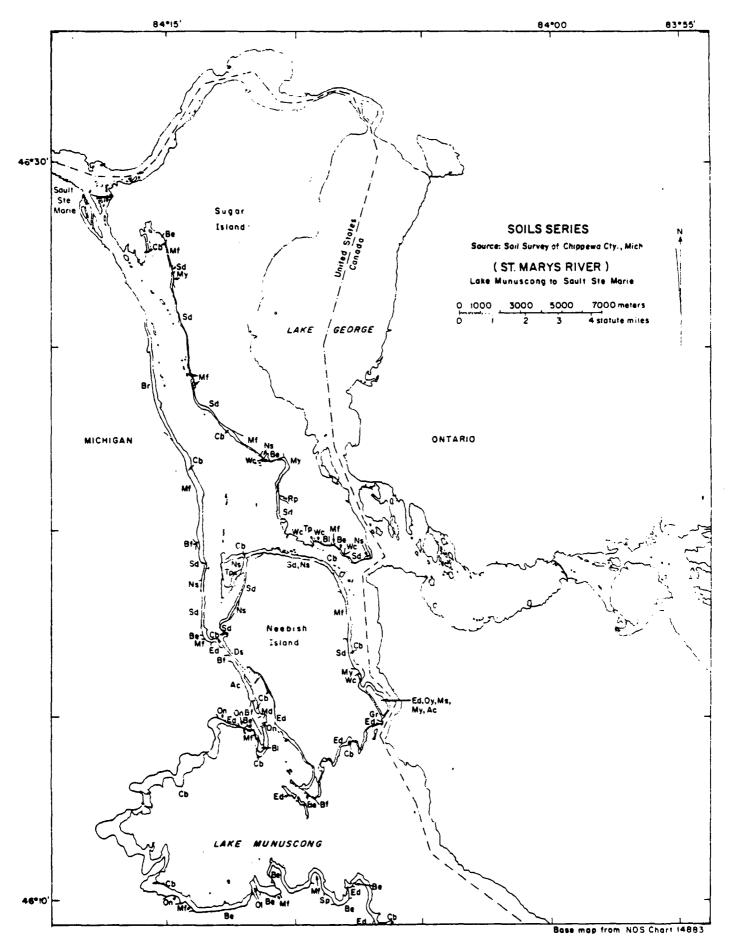
SMR reach 27b, 18 May 79

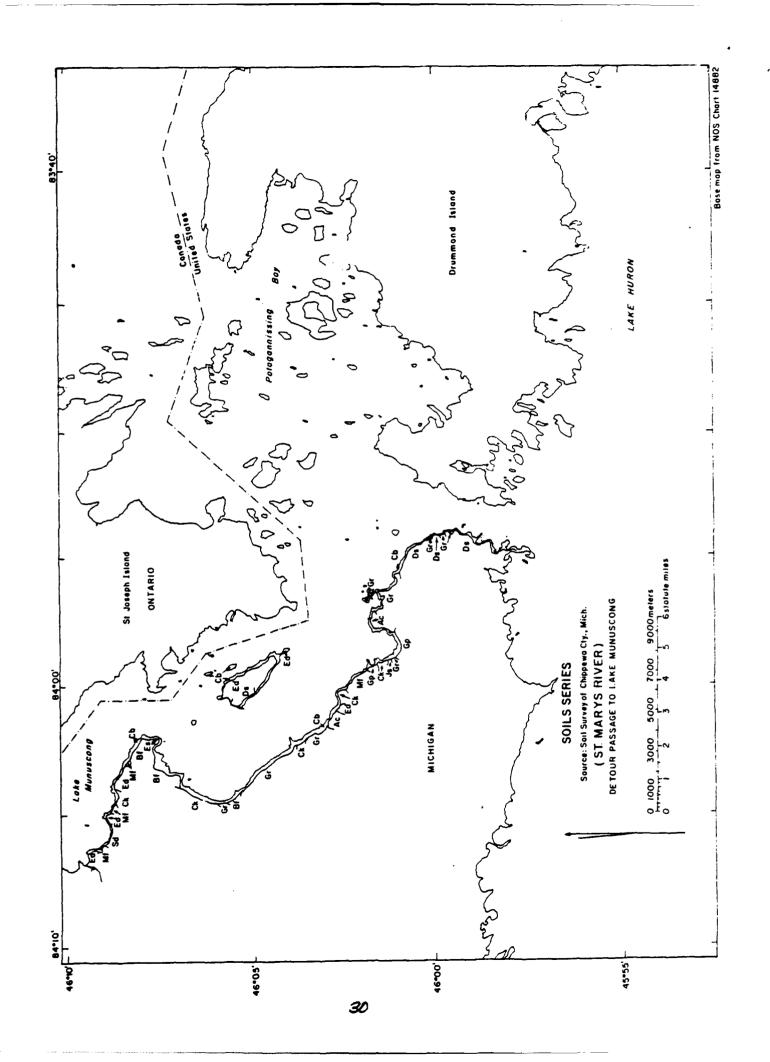
Bank soils from SCS soil surveys.

Soils Legend - St. Marys River (Chippewa County)

- Ac Alpena cobbly loam
- Be Bergland silty clay loam
- Bf Bruce fine sandy load
- Bl Bruce silt loam
- Cb Coastal Beach
- Ck Carbondale muck
- Ds Detour stony loam, shallow phase
- Ed Eastport sand
- Em Ewen silt loam, alluvial fan phase
- Es Emmet stony loamy sand
- Gp Greenwood peat
- Gr Granby sand
- Js Johnswood stony loam
- Md Made land
- Mf Munuscong fine sandy loam
- My Munising stony sand loam
- Ns Newton sand
- Ol Ontonagon silt loam
- On Onaway stony loam
- Os Ogemaw sandy loam
- Oy Ontonagon silty clay loam, slope phase
- Rp Rifle peat
- Sd Shelldrake sand
- Sp Spalding peat
- Ss Saugatuck sand
- Wc Waiska cobbly sandy loam







Descriptions, photographs and generalized river cross-sections for profiled reaches, some eroding reaches and selected sites (distances in feet).

SITE NO. SMR 1

Sample taken OYea O No

Sample taken	OYes O No							SHR 1
BEACH	O Yes	Orientation	2	Width	Texture	Remarks		****
rhoto No.	°£	NW-SE	10-	10-20	Gravelly sand			-
	Orlentation	Height	Slope	Length	-	°&: 0	Evidence of Groundwater Seepage Staining Damp Zone Vegetation	Other
BLUFF	NW-SE	5-20	45-60°	4000	Rills Gullie	æ!		lower on NW end (Fig. Dl)
Photo No.	Vegetation Collabsing Stabl	at ion Stable Type	Remarks	œ.				
	ିଳ	Gra	s Vegetation		on top of bluff	frequently overh	mat on top of bluff frequently overhangs (Fig. Dl and D2)	
	O Artificial (fill)	fill) Texture	ure	Color	Structures	Remarks		
2011	Natural	Sandy		Light tan	Stratified (Fig. D2)	Layers of grave	Layers of gravel and cobbles; till in bluff on southernend	n bluff on southernend
		1 2	\vdash	Texture	Bedforms RNo	Veget	ON CO	ırka
CONDITIONS	Shelf Steep Shelf X (Fig. D 3 and D13)	and D13)	Cobbl	Cobbles and gravel with		Type		Shelf is arm with cobbles and pebbles
	Residential	ntial	_	ಕ್ಷ ವ∣		Agricultural	Recreational None	Remarka
TANDUSE	Sparse D Med	Medium D Dense D	Sparse	Medium D	Dense D			Homes very scattered
	otect ive	tructures	Vegetated	_	Slope Nears	Nearshore Conditions	Remarks	
UPSTREAM		Gab Other	Bluff	Becomes		Similar	 Bluff height decreases	creases
Photo No.	None		×					
MATERIAL	Š	Structures	Vegetated	- 2		Nearshore Conditions	Renarks	
CONDITIONS Photo No.	None		×			Similar	Bluff height decreases	creases

REMARKS

Site descriptions, photographs and cross-sections for site I are included since these bluffs would probably erode very quickly if the water level was high enough to be at the toe.

Depressions near the waterline are filled with organic material eroded from shore Bluif heights vary from <1 to 20 ft; dense residental Undeveloped, low-lying plain Height of clumps Alders stabilize grass and form a series of promotories and inlets Same type of shoreline along Izaak Walton Bay with offshore islands (formed from dredge material) Clumps of grass and alder roots are eventually eroded from backshore; no distinct bluff; waves wash KNO SMR 4b Other Evidence of Groundwater Seepage Remarks Damp Zone Vegetation None × development Recreational Remarks Remarks Staining Density Vegetation Type Densi Nearshore Conditions (Fig. D4) Nearshore Conditions Surface Runoff x (10) Agricultural Remarks Similar (Fig. D5) Remarks Evidence of Similar Bedforms D No Not observable Dense 🗖 Ripples Structures Texture Sand Hed I um Slope Slope Commercial Gent le Gent le 1000 over shoreline Length Variable, Texture Color Sand Sparse Tan Vegetated Bluff Vegetated Bluff Remarks Slope No true bluff Texture Bathymetry Shelf/Drop off Grass/alder Dense 🗖 Ortentation N-S and E-W Sand Type 0-1.5 B.H. RR Gab Other B.H. RR Gab Other Height Sparse D Medium D Vegetation Collapsing Stable Skrifficial (fill) X (F18. D14) Steep Variable Orientation O Yes 2 D (C) (Natural Shelf DOWNSTREAM CONDITIONS NEARSHORE CONDITIONS CONDITIONS Photo No. Photo No. Photo No. Photo No. UPSTREAM LANDUSE BLUFF BEACH SOIL 33

Weather:

DATE

Sample taken DYes D No

SMR4b

SITE NO.

Twelve additional reaches occur along Site 4. They are small and separated by protected or stable banks. Offshore slope is gentle; with scattered areas of offshore vegetation along this reach. Grasses along Sherman Park may be actively eroding. REMARKS

SITE NO. SHRSA

Weather:

; : =

DATE

Sample taken Dyea D No	Yes O No								
BEACH	D X Yes	Orientation	Width	The state of the s	Texture	Remarks			SMK 3a
Photo No.	ž D	NNW-SSE	0-5		Gravel with cobbles		Branches and trees scattered over the beach	red over the beach	
	Orientation	Height	Slope	Length	Evidence of Surface Runoff	D.No	Evidence of Groundstation	Evidence of Groundwater Seepage D No	o Remarks
BLUFF	NNW-SSE	2-5	45°-90°	1000	R1116	¥ *			
Photo No.	I E	Ι.	Remarks						
	Collapsing St.	Stable Type Brush, trees,		Many roots ar	e exposed alon	are exposed along the bluff (F1g. D6)	. D6)		
SOIL	SArtificial (fill	٦	-	Color	Structures	Remarks			
	D Natural	with gravel	avel Grey	<u>.</u>	None	Clay under sa	Clay under sandy upper zone		
C) NEARSHORE	Bathy Shelf Steep	met ry She l		Texture	Bedforms (5) No		Vegetation XI No Re Type Density	Remarks	
△ CONDITIONS			Sandy		Not observable				
	Residential Sparse D Medium D	idential Medium (1) Dense (1)	Sparse	Commercial Medium m	Dense D	Agricultural	Recreational No	None Remarks	
LANDUSE								X No development on island	n island
UPSTREAM	Protective Structures B.H. RR Gab Oth	ructures b Other	Vegetated	Slope	_	Nearshore Conditions	Remarks		
ŝ	×			Vegetated		Similar	Riprap along shore and Coa:	Riprap along upstream 1s.and to protect park shore and Coast Guard 11ght	ect park
DOWNSTREAM	B.H. RR Gab	Structures Gab Other	Vegetated	Slope		Nearshore Conditions	Remarks		
CONDITIONS Photo No.	1			Vegetated		Similar			

Rest of Reach 5a on Island I has a grassy bluff with scattered small slide surfaces REMARKS

SITE NO SIME 64 DATE

OYes O %

Sample taken

Weather:

SMR 6d

Grass clumps lay along bottom nearshore Remarks Evidence of Groundwater Seepage D No Remarks Staining Damp Zone Vegetation Remarks None Water at base of grasses (Fig. D8) Water undercutting grass which eventually falls off as clumps Recreational Remarks Vegetation D No Nearshore Conditions ON X Agricultural Remarks Remarks Gullles Surface Runoff Rills Gullier Evidence of 2 Not caservable Dense 🛮 Stouctures Bedforms Texture Kipples Medium Slope Commercial Length 300 Color Very fine Texture Width Sparse Band Tan Vegetated Bluff Remarks No true bluff (Fig. D7) Slope Texture Bathymetry Steep Shelf/Drop off Dense 🖸 Orlentation Sandy Grass Type Protective Structures B.H. RR Cab Other Helght 1-2 Sparse E Medlum Vegetation Collapsing Stable Regidential O Artificial (fill) Steep X (Fig. D15) Or ientation D Yes S X E Hatural NW-SE Shelf CONDITIONS thoto No. Photo No. UPSTREAM LANDUSE BEACH BLUFF SOIL

Remainder of Site 6 has five scattered reaches of active erosion separated by protected banks, i.e. riprap, tree slawh, concrete slabs. Trees are collapsed at some reaches. REMARKS

Higher bluff, 1 to 7 ft, with trees; being protected with rip,

Remarks

Nearshore Conditions

Slope

Vegetated Bluff

Other

Sab

اچ

DOWNSTREAM CONDITIONS

Photo No.

CONDITIONS

Photo No.

Protective Structures

Partially

Gentle

Similar

Similar

SITE NO. SNR 11b DATE

Weather:

Sample taken	OYes O No								SMR 11b	1116
BEACH	Yes	Orientation	Wideh	=1	Texture	Remarks				
Photo No.	£	S-N	21-5		Fine sand	No beach wher	water level is u	ıp as 1n M	No beach when water level is up as in May 1979 (Fig. D9)	
	Orientation N-S	Height .5-1.5	Slope >60°	400	Evidence of Surface Runoff Rills Gullie	EKNo B	Evidence of Groundwater Seepage Staining Damp Zone Vegetation	Groundwate one Vege	MB No Other	Remarks No distinct bluff
BLUFF										
Photo No.	Vegetation	ton	Remarks							
	Collapsing St	Stable Type Grass and brush	Grass on promontor	bluff face ries and em	Grass on bluff face; soil eroded from promontories and embaym nts (Fig. D9)	from under gras D9)	is mat which event	ually col	Grass on bluff face; soil eroded from under grass mat which eventually collapses; bankline is a series promontories and embayments (Fig. D9)	a series
	O Artificial (fill		\vdash	Color	Structures	Remarks				
7108	Watural	Fine sand	Tan	lot	ot observed	Crassless blu	Grassless bluff occurs where clump has fallen off	lump has	fallen off	
	Bathy	Bathymetry	Texture	ture	Bedforms E No	-	ton Taylo	Remarks		
WEARSHORE CONDITIONS	Shelf Steep	(Pig. D16) Shelf/Drop off		Fine sand with scattered rock	Ripples	Type	Dens! ty	Grass clu Bottom ge	Grass clumps offshore near waterline. Bottom gets soft farther offshore.	aterline. shore.
	Residential	ntial	<u> </u> -	Commercial		Agricultural	Recreational	None	Remarks	•
LANDUSE	Sparse 5 Medi	Medium Dense	Sparse		Dense		×		Dunbar Park; grass field behind small bluff	field behind
	Protective Structures	tructures	Vegetated	Slope	-	Nearshore Conditions	Remarks			
CONDITIONS	B.H. RR Ga	Cab Other	Bluff	Very gentle		Stailar	Grassy, 8	entle plai	Grassy, gentle plain; no bluff	
TIME INC.	Protective St	tructures	Vegetated	Slope		Nearshore Conditions	Remarks			
CONDITIONS PLOTO NO	B.H. RR Gab Oth	ab Other	aluff	Very gentle		Similer	Bends int	Bends into Charlotte River	e River	
LINE WOLLD									 	

REMARKS

Remarks Evidence of Groundwater Seepage R No Staining Damp Zone Vegetation Other SMR 23b One house Remarks Remarks None Remarks Recreational Remarts Vegetation A No Looks like till Grass covers bank on northern portion (Fig. D11) F18. 010 Negrshore Conditions Nearshore Conditions S Q Agricultural Remarks Remarks Evidence of Surface Runoff RIIIs Guilles Similar Similar Bedforms DKNo Gravel to boulders Dense 🔲 Structures Texture None Vegetated Vegetated Commercial Medium Slope Length Texture Cobbles and boulders 009 Color Grey to Width tan Sparse 3-7 Vegetated Bluff Vegetated Bluff Remarks Slope 30°-60° Sand with cobbies and howldars Texture Bathymetry Steep Shelf/Drop off Dense Grasses Ortentation Type NNE-SSW Protective Structures B.H. RR Gab Other B.H. RR Gab Other X (Fig. D16) Height .5-7 Residential Sparse Tx Medium D Vegetation Collapsing Stable O Artificial (fill) Or lentation Q_XYes NNE-SSW 2 D Matural Sample taken D'Yes D No Shelf DOWNSTREAM CONDITIONS UPSTREAM CONDITIONS C. NEARSHORE Photo No. Photo No. Photo No. Photo No. LANDUSE BLUFF BEACH SOIL

Weather:

DATE

SITE NO. SMR 23b

REMARKS

Remarks SMR 24b Evidence of Groundwater Seepage , No Staining Damp Zone Vegetation Other Remarks Bank is grass mat that has slumped down after soil has eroded from underneath Remarks None Remarks Remarks Recreational Vegetation DNO Type Density Nearshore Conditions Nearshore Conditions on OX Agricultural Remarks Remarks Surface Runoff Rills Gullies Similar Evidence of Bedforms O No Not observable Dense 🔲 Structures Ripples Texture Sand Vegetated Commercial Medium Slope Length 300 Clayey silt Tan Color Texture Width Sparsed Vegetated Bluff 0-5 Vegetated Remarks Not a dis-tinct bluff Slope Texture Bathymetry Steep Shelf/Drop off Grasses and Dense 🛘 Or tentat Ion Sandy Type B.H. RR Gab Other Protective Structures B.H. RR Gab Other Height 0-2.5 E-W Sparse D Medium D Vegetation Collapsing Stable Artificial (fill) Orientation O Yes ê D A Natural Sample taken OYes ONo E-W Shelf × (U NEARSHORE CONDITIONS Photo No. Photo No. UPSTREAM Photo No. LANDUSE BLUFF BEACH SOIL

Weather:

DATE

SMR 24b

SITE NO.

SMR 24a (Little Neebigh Store) was an old Corps profile site. It did not erode between May 1977 and October 1975. I did not prepare a detailed site description since there is no evidence for erosion (Fig. D12).

Similar

Vegetated

DOWNSTREAM CONDITIONS

Photo No.

REMARKS

SITE NO. SMR 278

Sample taken DYes D No

DATE

Weather:

Trees, brush and grass on top of bank in northern portion; scattered slides along southern portion Remarks **SMR 27a** Evidence of Groundwater Secpage XI No Staining Damp Zone Vegetation Other Remarks • Remarks None Scattered riprap Scattered riprap Remarks Recreational Remarks Vegetation LXNo Type Density Nearshore Conditions Nearshore Conditions Surface Runoff X No Agricultural Remarks Remarks Similar Similar Evidence of Bedforms D No Dense 🗆 RIIIB Structures Texture alpples None Sand Vegetated Commercial Medium Vegetated Slope Slope Length Texture Fine sand on clay Color 400 ag. Widch Sparse 0-15 Vegetated Vegetated Bluff Remarks Texture Clayey sand with gravel near top Slope 900 Shelf Steep Shelf/Drop off X (Fig. Di5) Dense D Orientation Type Grass N-S Protective Structures B.H. RR Gab Other Protective Structures B.H. KR Gab Other Height Sparse D Medium D .5-4 Vegetation Collapsing Stable O Artificial (fill) Orlentation T Yes ê D A Natural S-N DOWNSTREAM CONDITIONS Photo No. CONDITIONS UPSTREAM CONDITIONS Photo No. Photo No. Photo No LANDUSE BEACH BLUFF SOIL

SMR 27b is an old Corps of Engineers profile site. It was protected with boulder riprap between 1974 and 1977. REHARKS



Figure D1. Sift site 1, 26 May 77.



Figure D2. SMR site 1, 22 May 78.



Figure D3. SMR site 1, 22 May 78.

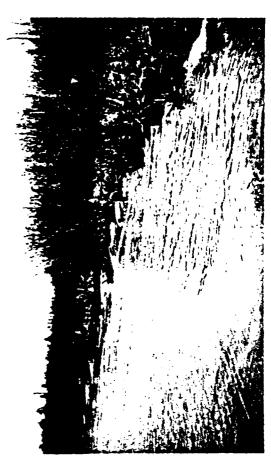


Figure D4. SMR reach 4b, east portion, 22 May 78.



Figure D5. SMR reach 4b, west portion, 3 Nov 78.

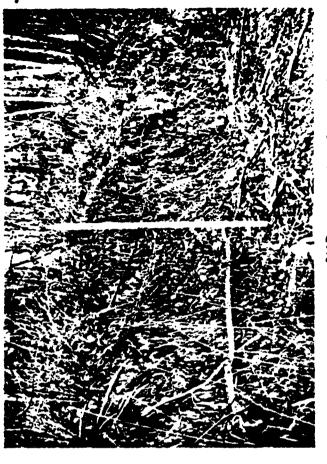


Figure D6. SMR reach 5a, 2 Nov 78.

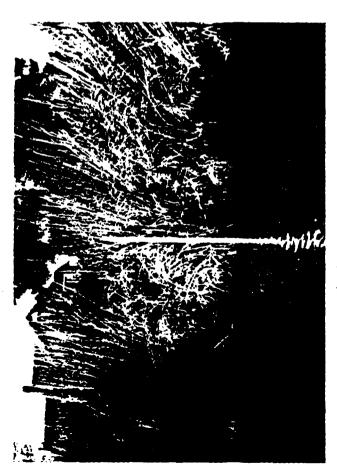


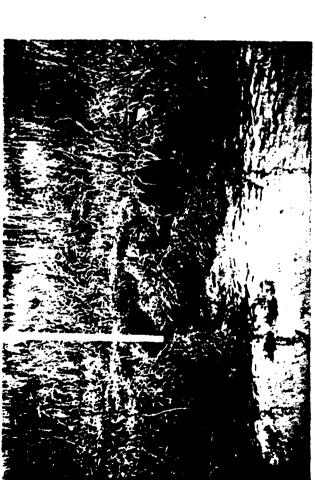
Figure D7. 514k reach 6d, 3 Nov 78.



Figure D8. SMR reach 6d, 23 May 78.



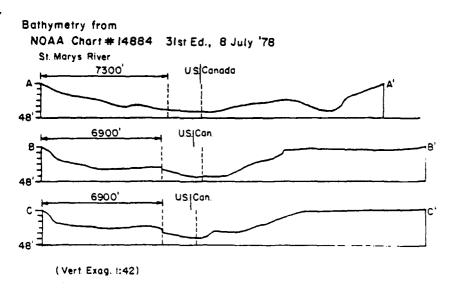
SMR reach 23b, 23 May 78. Figure D10.



SMK reach 11b, 6 Oct 79. Figure D9.



reach 23b, 23 May 78. Figure Dil.



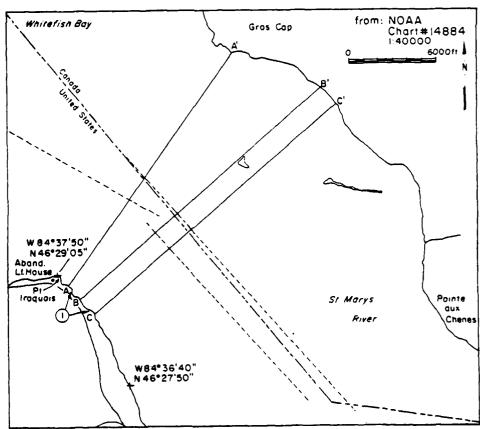
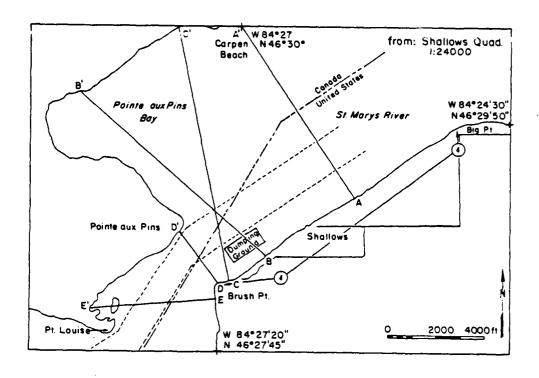


Figure D13. Generalized river cross-sections, site 1, St. Marys River.



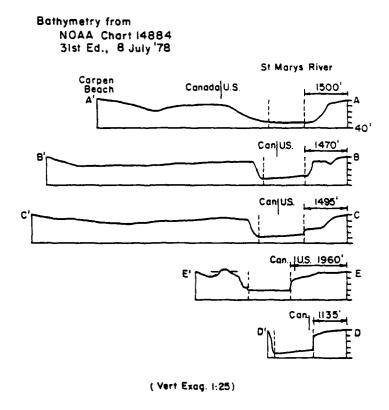


Figure D14. Generalized river cross-sections, site 4, St. Marys River.

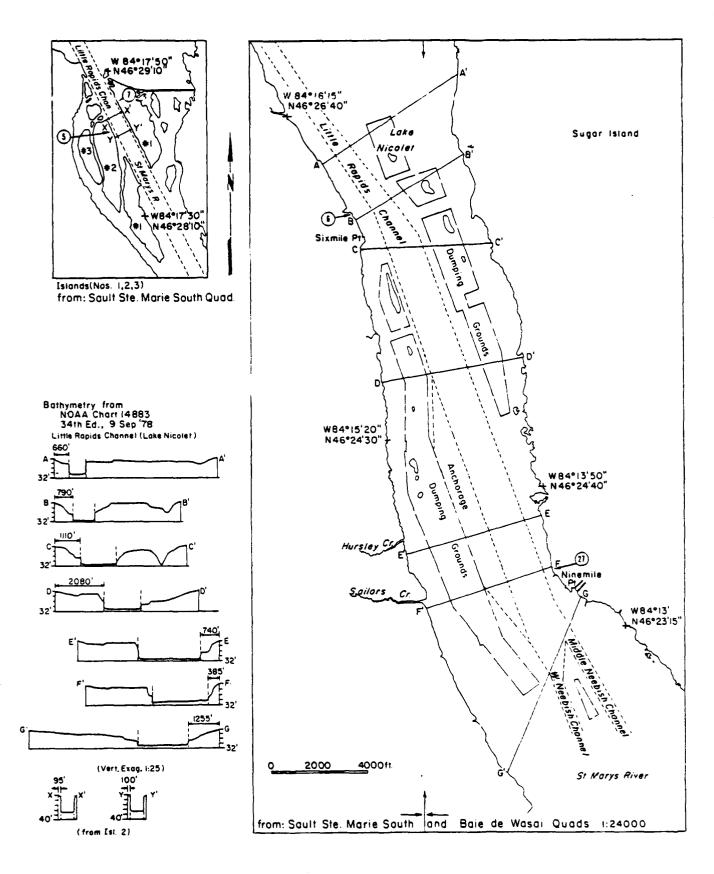
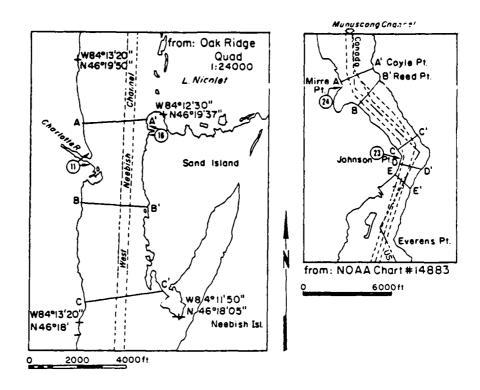


Figure D15. Generalized river cross-sections, reach 5a, site 6 and site 27, St. Marys River.



NOAA Chart #14883 (L.Nicolet — E.Neebish Ch.)

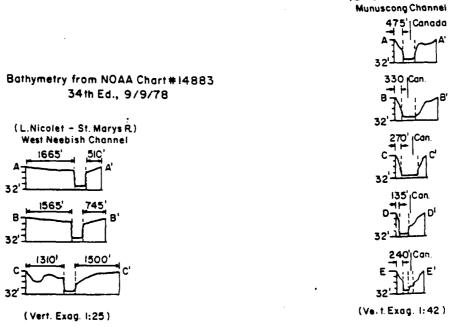
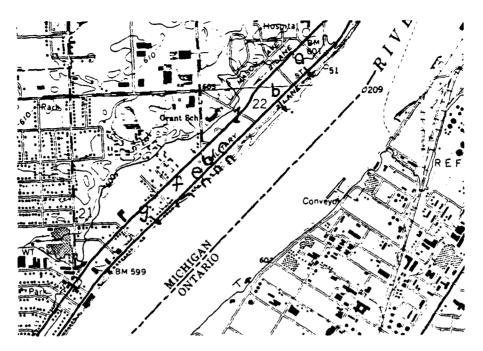
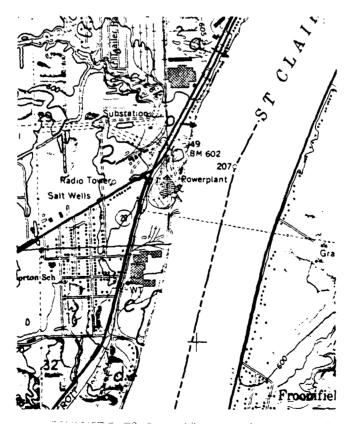


Figure D16. Generalized river cross-sections, near sites 11, 16, 23 and 24, St. Marys River.

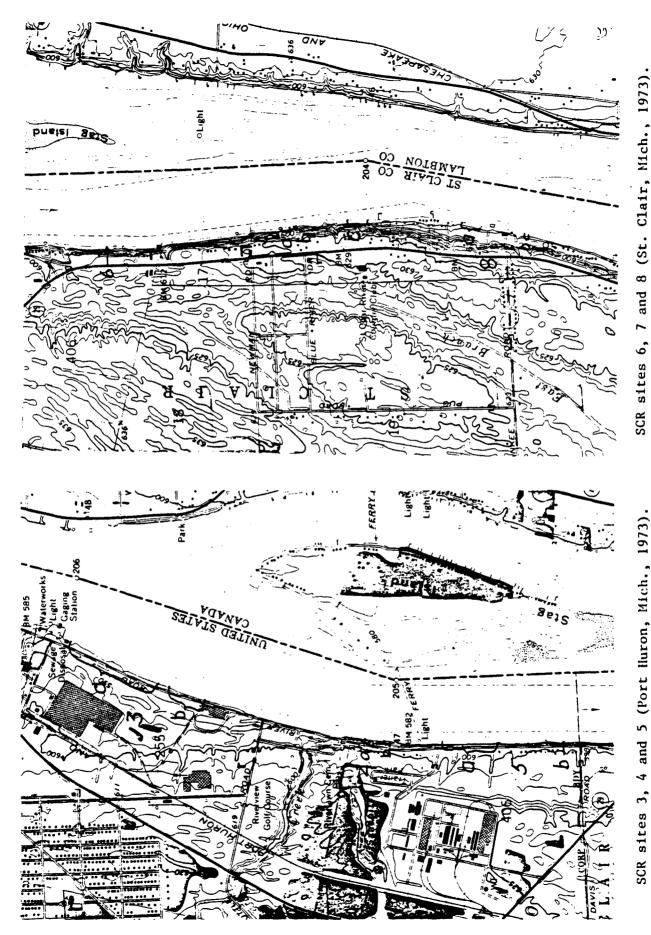
Locations of partially vegetated and bare banks (shown on portions of U.S.G.S. 7-1/2 minute-series topographic maps).



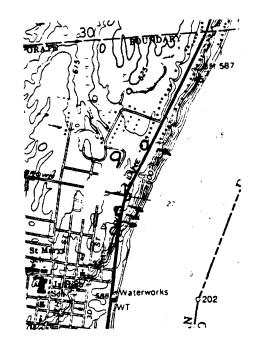
SCR site 1 (Port Huron, Mich., 1973).



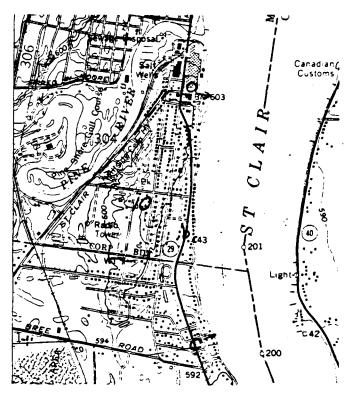
SCR site 2 (Port Huron, Mich., 1973).



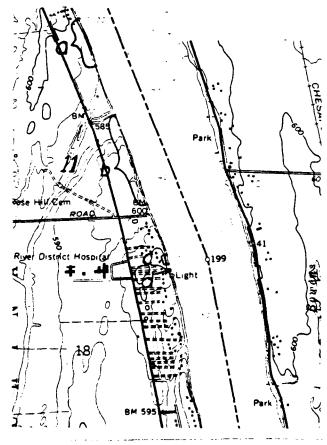
(Port Huron, Mich., 1973). 4 and 5 SCR sites 3,



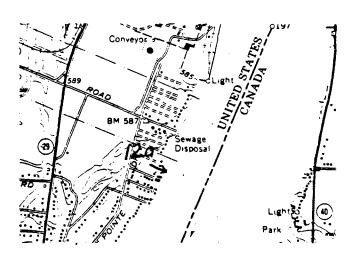
SCR site 9 (St. Clair, Mich., 1973).



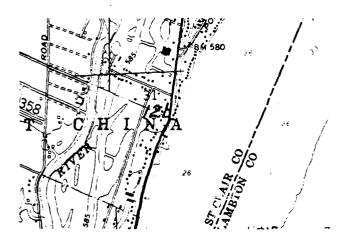
SCR site 10 (St. Clair, Mich., 1973).



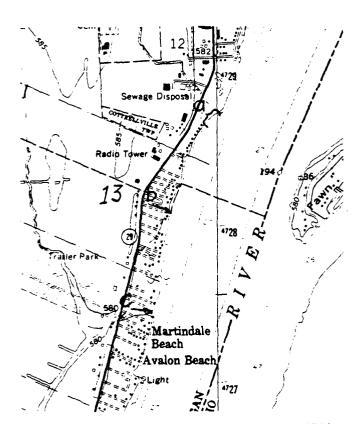
SCR site 11 (St. Clair, Mich., 1973).



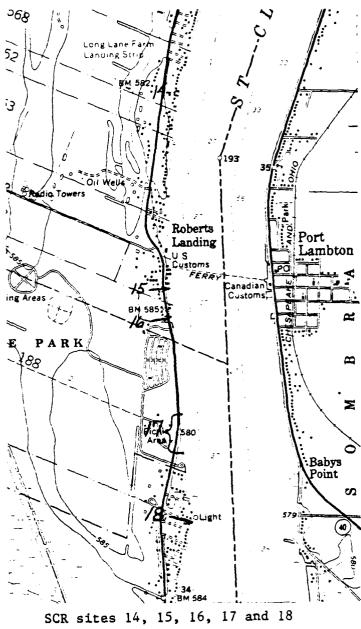
SCR site 126(St. Clair, Mich., 1973).



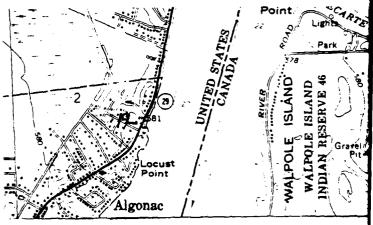
SCR site 12b(Marine city, Mich., 1973).



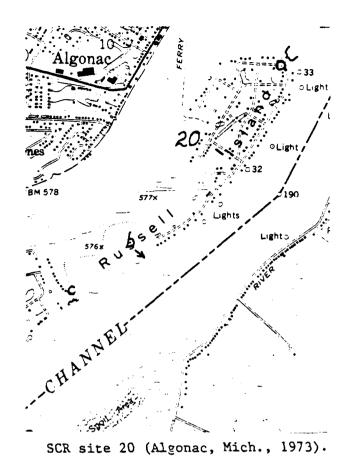
SCR site 13 (Marine City, Mich., 1973).



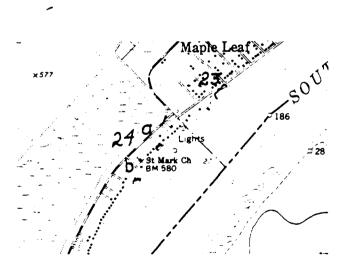
SCR sites 14, 15, 16, 17 and 18 (Marine City, Mich., 1973).

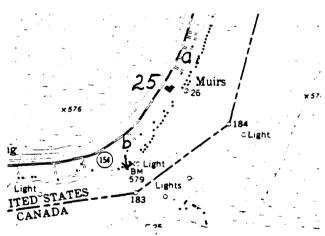


SCR site 19 (Marine City, Mich., 1973).



SCR sites 21 and 22 (Algonac, Mich., 1973).

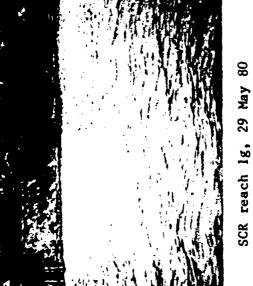




SCR site 25 (Algonac, Mich., 1973).

SCR sites 23 and 24 (Algonac, Mich., 1973).

Selected photographs that illustrate the diversity of the eroding banks; not all eroding banks are shown.





SCR reach 1f, 31 Oct 78



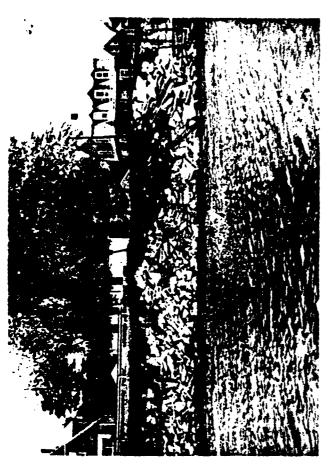
SCR reach le, 29 May 80



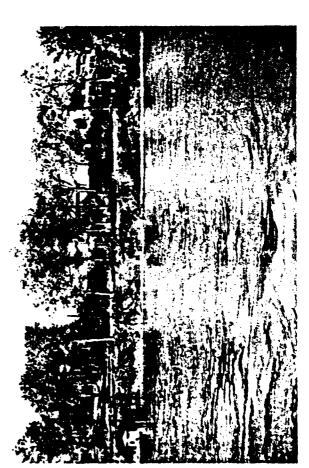
SCR reach 1f, 23 Hay 77



SCR reach 2b, 23 May 77



SCR reach 2d, 23 May 77



SCR reach 7a, 18 Oct 77



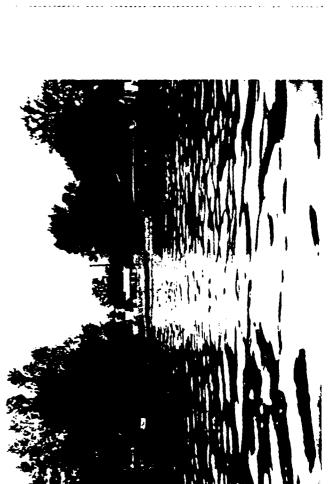
SCR reach 7b, 23 hay 77



SCR reach 9a, 23 May 77



SCR reach 7c, 29 May 80



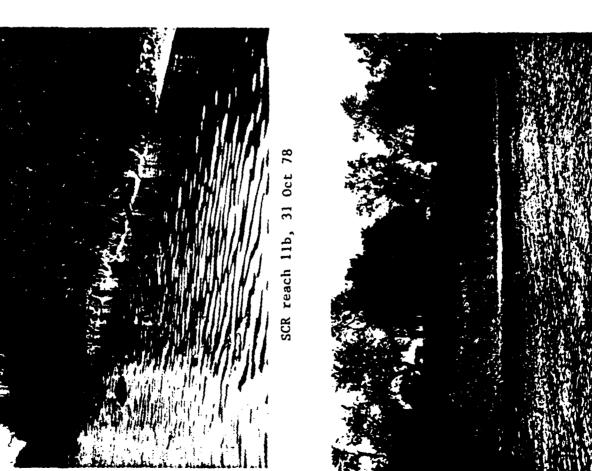
SCR reach 10b, 29 May 80



SCR reach 11a, 23 May 77



SCR reach 11b, 31 Oct 78





SCR site 17, 19 May 79



SCR reach 20a, 22 May 78



SCR reach 20a, 22 May 78

Bank soils from SCS soil surveys.

Soils Legend - St. Clair River (St. Clair County)

AhB Allendale-Hoytville complex

Alluvial land Au

Bc Bach very fine sandy loam

EaB Eastport sand

Lake beaches La

Lm Lenawee silt loam

LnA Lenawee complex

Md Made land

MoA Minoa fine sandy loam MrA Minoa fine sandy loam, clay substratum

MsA Minoa-Lamson complex

NhA Nappanee-Hoytville complex

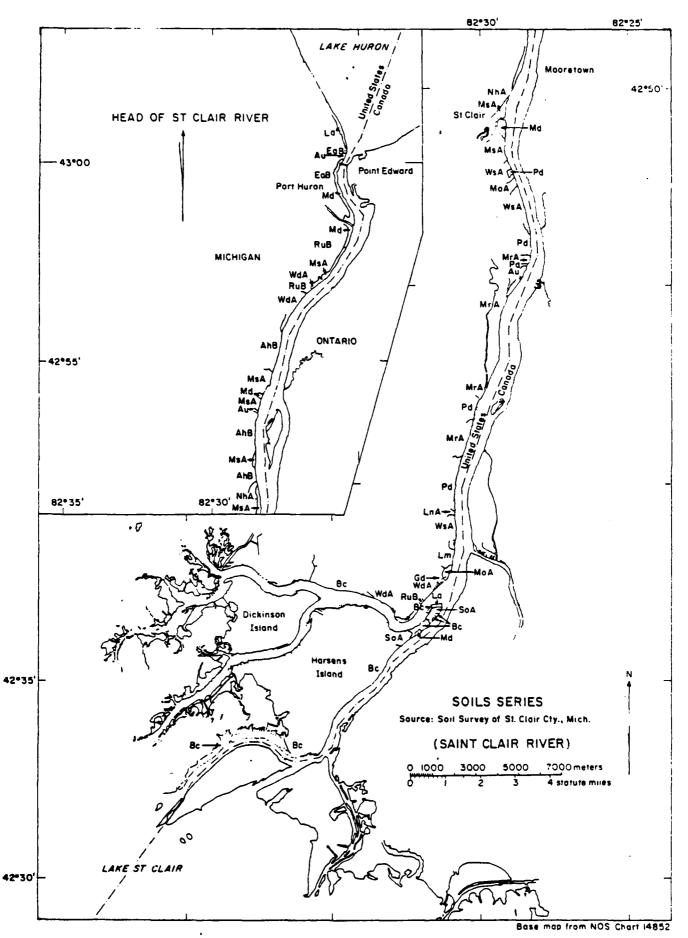
Pd Pauling clay

RuB Rousseau fine sand

SaA Sanilac very fine sandy loam

WdA Wainola-Deford fine sands

WsA Wasepi sandy loam, clay subsoil variant



Descriptions, photographs and generalized river cross-sections for profiled reaches, some eroding reaches and selected sites (distances in feet).

SITE NO. SCR 3a DATE

Weather:

Sample taken OYes D No	JYes 🗖 No								SCR	SCR 3a
BEACH	O Yes	Orfentation	2	Width	Sand with ecatters	Remarks				
rhoto No.	£	NE-SW	<u>-</u>	1-15	gravel and cobbles	o co				
	Orientation	Height	Slope	Length	Eviden Surface	ce of Runoff D No	Staining Damp Zone Vegetation	Croundwate Zone Vege	Vegetation Other	Remarks On north end,
BLUFF	NE-SW	0-2 20	20°-60°	2000	R1118	Gullies				no distinct bluff (Fig.Dl8)
Photo No.	Vegetation Collapsing Stabl	ation Stable Type	Remarks	(8 Sloated clu	umps of grasses	fallen along ba	nk, separated by	vegetated	k <u>a</u> s <u>io</u> ated clumps of grasses fallen along bank, separated by vegetated bluff (Fig. Di9)	
	×	Grass		;						
2011	O Artificial (fill	111) Texture	ure	Color	Structures	Remarks				
	A Natural	Clayey sand	sand	Tan	No					
6 NEARSHORE	Shelf Steep	Bathymetry teep Shelf/Drop off		Texture	Bedforms E No	o Vegetation Type Dens	ion XID No Density	Remarks Shelf is	Remarks Shelf is wider on north end of reach	of reach
CONDITIONS	٦			Sand	Ripples					-
	ē		Spergo	Commercial	fal Dense	Agricultural	Recreational	None	Remarks	
LANDUSE	d agrade						×		Park on north end	
	otective	ructures	Vegetated	_	Slope Nears	Nearshore Conditions	Remarks			
UPSTREAM CONDITIONS Phore No.	X KR Gab	o Other	Bluff		YS .	Similar	Bulkhead u	pstream of	Bulkhead upstream of the northern end of reach	f reach
DOWNSTREAM	B.H. RR Gab Oth	ructures b Other	Vegetated Bluff		Slope Nears	Nearshore Conditions	Remarks			
Photo No.			×	-	75	Similar				

Site 3b separated from 3a by a vegetated bluff; road very near the top of bluff along 3b; trees and brush have dollapsed at 3b (Fig. D20). REMARKS

DATE		
SITE NO. SCR 4b	Sample taken DYen D No	

Sample taken	DYen D No								SCR 4b	
BEACH	Дхуев	Orientation N-S		Width 0-5	Texture Sand with scattered	Remarks				
Photo No.	ş D) :			boulders (Fig. D21)	0 <u>2</u> 1)		•		
	Orientation	lle ight	Slope	Length	_	Evidence of	Evidence of Groundwater Seepage Statistics Damp Zone Vegetation	Groundwate	Water Seepage CANO	Remarks
	S-N	3-4	45°-60°	100	Rills Gullie	no i				
BLUFF	,		ł							
Photo No.	Vegetation	ion	Remarks	ks						
	Collapsing Stable X (Fig. D22) G1	(Fig. D22) Grass/trees	<u></u>	of the blus	ff is vegetaied when the water	Most of the bluff is vegetated, but at toe, there is a dithat has formed when the water level is high (Fig. D23).	re is a distinct (Fig. D23).	vertical s	Most of the bluff is vegetated, but at toe, there is a distinct vertical scarp less than I ft high that has formed when the water level is high (Fig. D23).	ft high
	Artificial (fill)	-	Texture	Color	Structures	Renarks				
2011	A Natural	Claye	Clayey sand	Tan	No.					
		Rothymotry	Ļ	Texture	Redforms 13 No	-	rion XI No	Remarks		
CNEARSHORE	Shelf Steep	Shelf/Drop off					Type Density			
A CONDITIONS	_	(2) X		Sand	Not observable					
	Reg 1dent lal	ıt lal	_	Commercial	ial	Agricultural	Recreational	None	Remarks	
	Sparse E Medi	Medium Dense	Sparsed	_ 1	Dense 🖸					
LANDUSE									Vacant log (Fig. D21)	021)
	Protective Structures	ructures	Vegetated	\vdash	Slope Near	Nearshore Conditions	Remarks			
UPSTREAM	B.H. RR Gab	b Other	Bluff							
CONDITIONS	×				S	Similar	Wood bulkhead	khead		
CHOCO NO.	otective	ructures	Vegetated	\vdash	Slope	Nearshore Conditions	Remarks			
DOWNSTREAM	B.H. RR Cab	Other	Blurr							
Photo No.	×				S	Similar				

Reach 4a is to the north. It is 100 ft wide with bluff 10 ft high, small scarp formed on the left side at toe of large bluff (Fig. D24) REMARKS

SITE NO. SCR SA

DATE

Weather:

SCR 5a

Sample taken OYes D No

		Orthopton	-		Towhire	Romarka				
		מי זכוווים וייי		-1	ravelly sand with	_				
Photo No.	ş D	S-K		07-1	scattered boulders					
51	Orientation	Height	Slope	Length	Evider	o _X	Evidence of Groundwater Seepage Staining Damp Zone Vegetation	Groundwat (Water Seepage XV No Vegetation Other	Renarks
BLUFF	S-X	5-15	45°-60°	1200	X X					
Photo No.	Vegetation	lon	Remarks	rka						
	Collapsing Stab X (Fig. D25)	er Gra		s of p 1-2	this bank at north end appear stable ft high at high waterline (Fig. D28)	end appear stabl terline (Fig. D2)	e (Figs. D26 and 8)	D27); toe	this bank at north end appear stable (Figs. D26 and D27); toe of bluff on south end has ft high at high waterline (Fig. D28)	end has
	Artificial (fill)	S C	Texture	Color	Structures	Remarks				
Soil	D élatura l	Sandy	Sandy clay	Grey to tan	No, massive					
	Bathy Shelf Steep	Bathymetry teep Shelf/Drop off	off	Texture	Bedforms 5 No	Veget	ation AND Density	Remarks		
CONDITIONS	E.			Sand	Ripples					
	Residential Sparse D Medium D	sidential Medium D Dense	Sparse	Commercial Nedium D	otal Dense	Agricultural	Recreational	None	Remarks	
LANDUSE								×	Borders a road	
UPSTREAM	Protective Structures B.H. RR Gab Oth	Structures Gab Other	Vegetated	_	Slope Nears	Nearshore Conditions	Remarks			
s .	1		}	i	SI	Similar		1		
	Protective Structures B.H. RR Gab Oth	Structures Gab Other	Vegetated		Slope Nears	Nearshore Conditions	Remarks			
Photo No.	×			_	Sti	Similar				

REACH Sb is a small vegetated bluff with a scarp at the toe (Fig. D29).

DATE SITE NO. SCR 11h

Weather:

SCR 11b

Sample taken DYes DNo

BEACH	TX Yes	Ortentation	5	Width	Texture	Kemarks				
Photo No.	ê B	NNW-SSE	0-10		Gravelly sand (Fig. D30)					
81n18	Orientation NNW-SSE	Height 2-20	Slope 45°-60°	Length 2000	Evidence of Surface Runoff Rills Gullies	og Pig	Evidence of Grou Staining Damp Zone	roundwater ine Vegetu	Evidence of Groundwater Seepage R No ing Damp Zone Vegetation Other	Renarks
Photo No.	Vegetation Collapsing Stable X (Fig. D31)	ation Stable Type Crasses and trees		Waterllithis this site	ne at toe of b (Figs. D32 and	luff has formed ø D33); north end	i 1-2 ft vertical looks more stabl	scarp at e, grass to	Remarks Waterline at toe of bluff has formed a 1-2 ft vertical scarp at the toe along the southern part of this site (Figs. D32 and D33); north end looks more stable, grass is growing at the toe (Fig. D30)	southern se
301L	GART!ficial (fill)		ure 1ay	Color Tan No	Structures No; looks massive	Remarks				
റ്റ NEARSHORE ട് CONDITIONS	Bathyme Shelf Steep (Fig. D43)	Bathymetry teep Shelf/Drop off R. D43) X		Texture Clay <u>ey sand</u> With scattered	Bedforms G No Ripples	Vegeta Туре	Density	Remarks		
LANDUSE	Sparse D Hec	Residential Medium Dense	Sparsed	Commercial Medium	1 Dense 🗖	Agricultural	Recreational	None X	Remarks Vacant lot	
UPSTREAM CONDITIONS	B.H. RR Gab Oth	Structures Gab Other X	Vegetated Bluff X	d Slope		Nearshore Conditions Similar	Remarks Poured con	crete over	Remarks Poured concrete over bank at scattered locations	locations
DOWNSTREAM CONDITIONS Photo No.	Protective Structures B.H. RR Gab Oth	Structures Gab Other	Vegetated Bluff	d Slope		Nearshore Conditions Similar	Remarks			

Remainder of reach and 11a,c and d (Figs. D34 and D35) are similar to 11b. REMARKS

Weather: DATE Sample taken OYes O No SITE NO. SCR 12b

Sample taken []	OYes O No								SCR 12b	
ВЕАСН	O Yes	Orientation	<u> </u>	Width	Texture	Remarks				
Photo No.	<u>\$</u>	NE-SW	0-3		Sand					
	Or lentation	Height 45	Slope 52-60°	Length 400	Evidence of Surface Runoff	e Q	Evidence of Groundwater Seepage Staining Damp Zone Vegetation	Groundwat Zone Veg	Water Seepage XINO Remarks When Vegetation Other water level is	en 18
BLUFF				}	R1118	Cullies			ligh, waterline is at toe of hine (Fig. 174)	ine f
Photo No.	Collapsing Stable X (Fig. D37)	on ble Type Grass	Remarks Scattere thrown o	ed riprap or on bluff; no	n south end; co	Remarks Scattered riprap on south end; concrete slabs on bluff face and thrown on bluff; northern part appears more stable (Fig. D38).	bluff face and l le (Fig. D38).	blocks at	Remarks Scattered riprap on south end; concrete slabs on bluff face and blocks at bluff toe; brush and logs thrown on bluff; northern part appears more stable (Fig. D38).	
SOLL	O Artificial (fill)	11) Texture	_	Color	Structures	Renarks				
	(1) Watura !	Sand	<u> </u>	Tan Non.	None observable					
O NEARSHORE	Shelf Steep Sh	Shelf/Drop otf	-	Texture	Bedforms 5 No	Veget	ation A No Density	Remarks		
CONDITIONS	(F)	•	Sand		None observable					
	اق	١	3000	Commercial	l	Agricultural	Recreational	None	Remarks	
LANDUSE	The section of the se		Tag space		T aguar			×	Borders a road	
	B.H. RR Gab Oth	uctures	Vegetated Bluff	Slope		Nearshore Conditions	Remarks			
CONDITIONS Photo No.	×				Sta	Similar				!
5	B.II. RR Gab Oth	uctures Other	Vegetated Bluff	Slope		Nearshore Conditions	Remarks			
CONDITIONS Photo No.	×		×		Sti	Similar				

REMARKS

SITE NO. SCR. 12 Weather:

Sample taken [OYes O No								SCR 17	
BEACH	O Yes	Ortentation	3	Width	Texture	Remarks				
Photo No.	ê B	S-N	<u>.</u>	3-10 (Fi	Gravelly sand (Fig. D39)					
	Orientation	Height	Slope	Length	Evide	Evidence of	Evidence of	2	on TO	Remarks
	N-S		Nearly		Surface	Surface Runoff XE No	Staining Damp Zone	Zone Vegetation	Othe	
BLUFF			vertical	200	K1118	culles				
:										
Photo No.	Vegetation	Stable Tune	Kemarks	m !						
			Clumps	Clumps of grass scattered alvecession is less (Fig. D41)	attered along (Fig. D41)	toe of bluff (Fig. D40); where	rees are at	Clumps of grass scattered along toe of bluff (Fig. D40); where trees are at the water line amount of recession is less (Fig. D41)	of
	DARTIFICIAL (fill)	111) Texture	ure	Color	Structures	Remarks				
SOIL	X Natural	Sand over clay		soil, tan	o N	Shows clear	Shows clear soil profile			
		ě	-	Texture	Bedforms CKNo	vo Vegetation	t lon EKNo	Remarks		
6 NEARSHORE	Shelf Steep	Shelf/Drop off		with		Type	Density	Several of	Several offshore linear depressions	ons
SNOILIONO,	X (F1g. D44)	D44) X	scatt	scattered rocks			i	parallel to	parallel to beach along the shelf	į.
	Residential	ıtlal	L	Commercial	11	Agricultural	Recruational	None	Remarks	
	Sparse E Hedi	Medium Dense	Sparse		Dense D			-		
LANDUSE							×	,	Algonac State Park	
UPSTREAM	Protective Structures B.H. RR Gab Oth	ructures b Other	Vegetated Bluff	Slope		Nearshore Conditions	Remarks			
CONDITIONS Photo No.	i					Similar	Cabton or	Gabion on beach at north end	orth end	
DOWNSTREAM	B.H. RR Gab Oth	Structures Gab Other	Vegetated Bluff	Slope		Nearshore Conditions	Remarks	·		
CONDITIONS Photo No.	×				S	Similar				

REMARKS



Figure D17. SCR reach 3a, 19 May 79.



igure D18. SCR reach 3a, north end, 19 May 79.

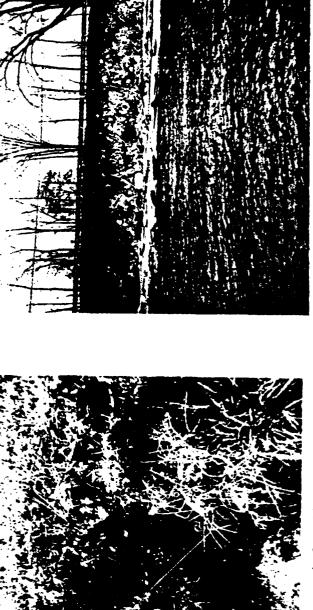


Figure D19. SCR reach 3a, 31 Oct 78.

SCR reach 3b, 20 May 78.

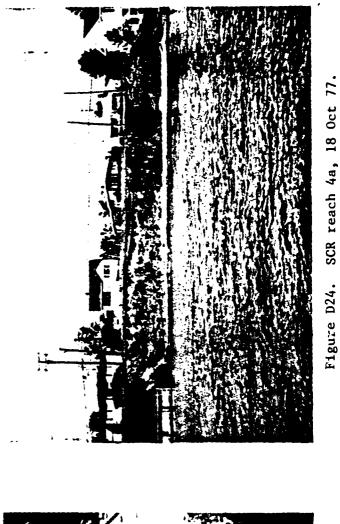
Figure D20.



SCR reach 4b, 31 Oct 78. Figure D21.



SCR reach 4b, 31 Oct 78. Figure D22.



31 Oct 78.

SCR reach 4b, Figure D23.



Figure D25. SCR reach 5a, 18 Oct 77.



Figure D26. SCR reach 5a, north end, 18 Oct 77.



Figure D27. SCR reach 5a, 19 May 79.



Figure D28. SCR reach 5a, 4 Oct 79.

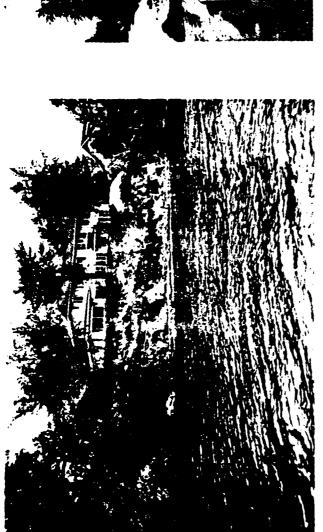


Figure D29. SCR reach 5b, 23 May 77.



Figure D30. SCR reach 11b, north end, 19 May 79.



Figure D31. SCR reach 11b, 23 hay 77.

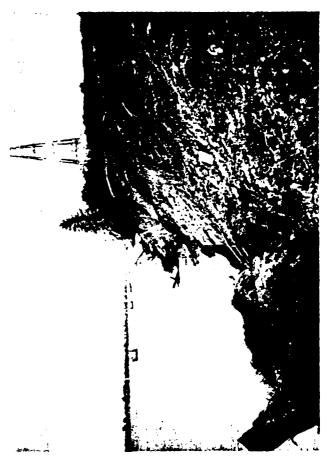


Figure D32. SCR reach 11b, 19 May 79.



Figure D33. SCR reach 11b, 23 May 77.

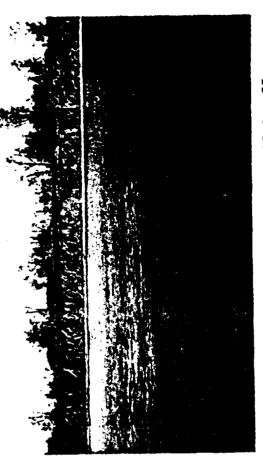


Figure D34. SCR reach 11a, 18 Oct 77.



Figure D35. SCR reach 11d, 18 Oct 77.



Figure D36. SCR reach 12b, 4 Oct 77.



Figure D37. SCR reach 12b, 19 May 79.

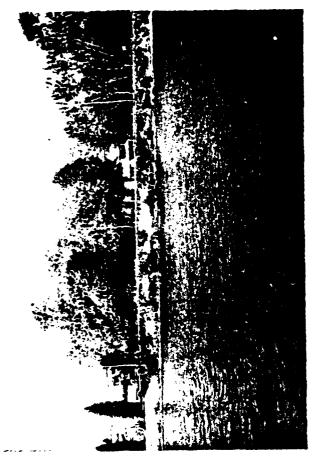


Figure D38. SCR reach 12b, 18 Oct 77.

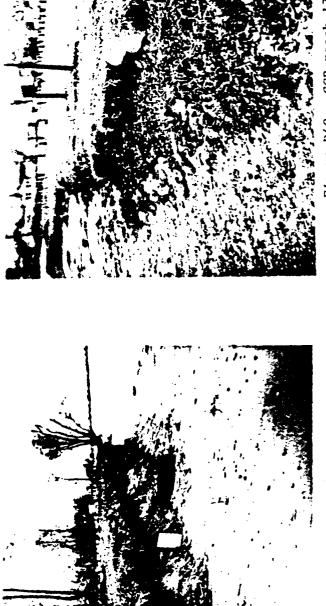


Figure D39. SCR reach 17, 19 May 79.



Figure D41. SCR reach 17, 23 May 77.

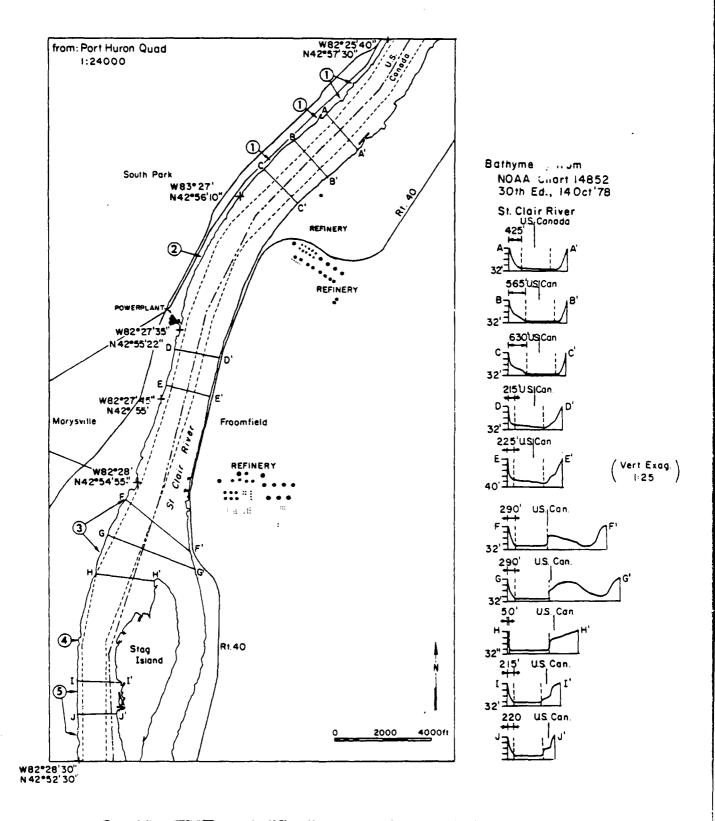


Figure D42. Generalized river cross-sections, sites 1 to 5, St. Clair River.

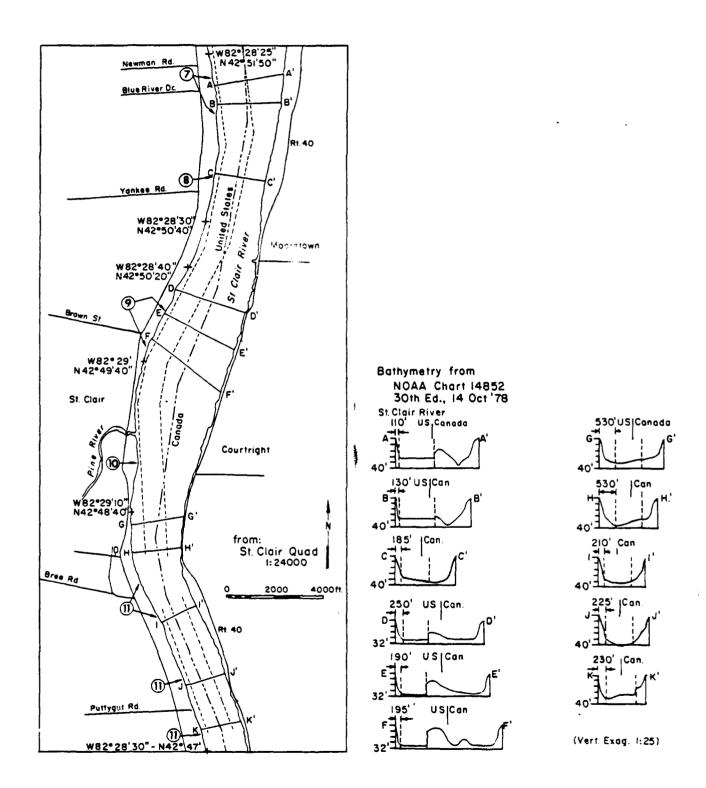


Figure D43. Generalized river cross-sections, sites 6 to 11, St. Clair River.

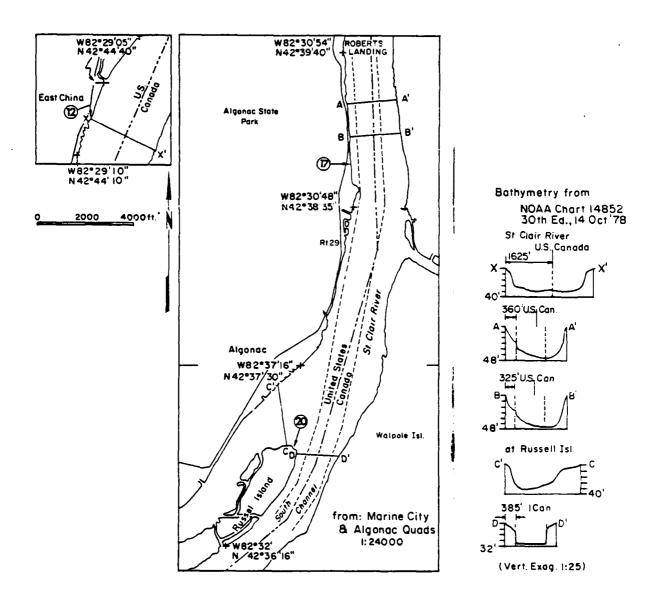
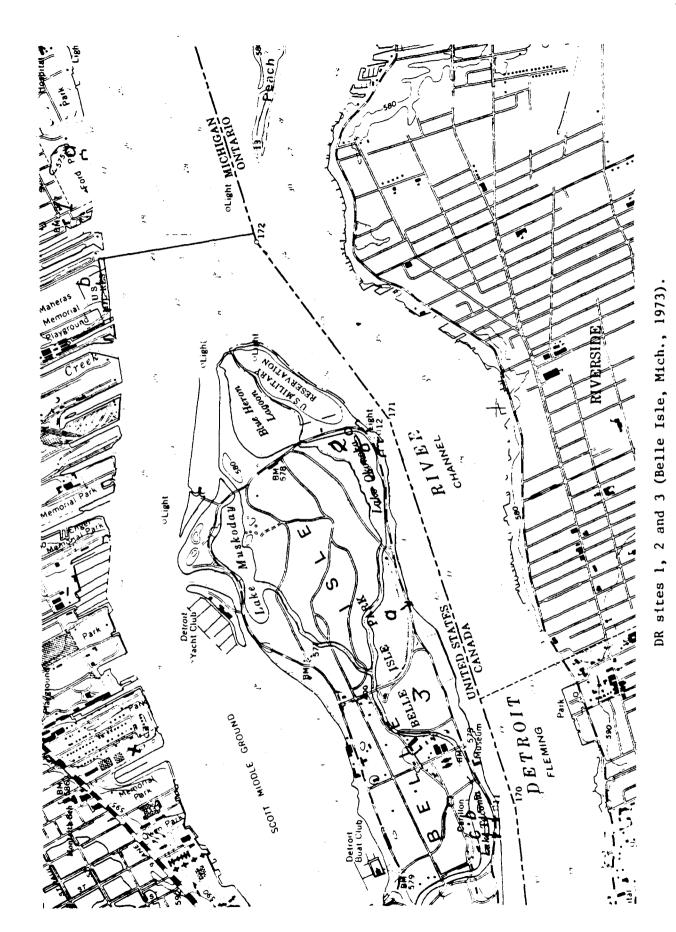
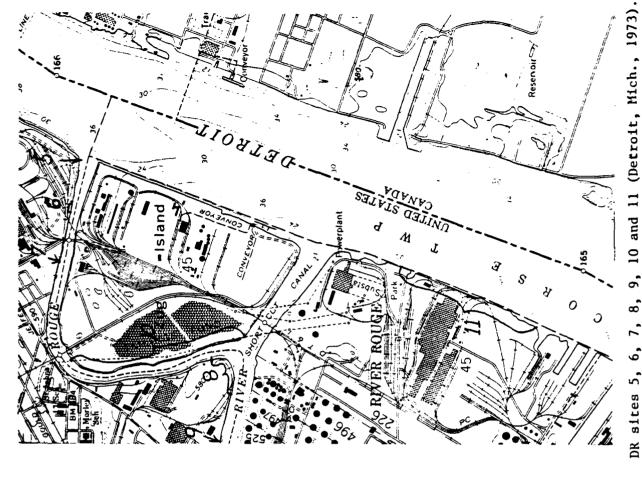


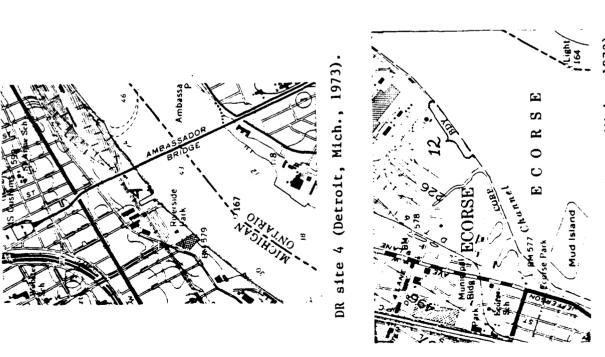
Figure D44. Generalized river cross-sections, sites 13 to 20, St. Clair River.

Detroit River

Locations of partially vegetated and bare banks (shown on portions of U.S.G.S. 7-1/2 minute-series topographic maps).

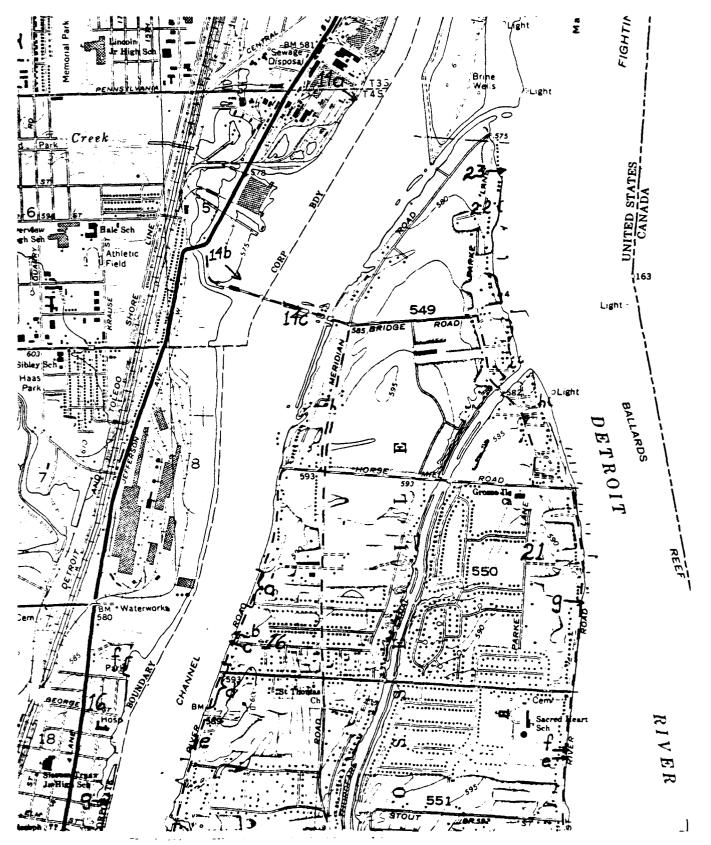




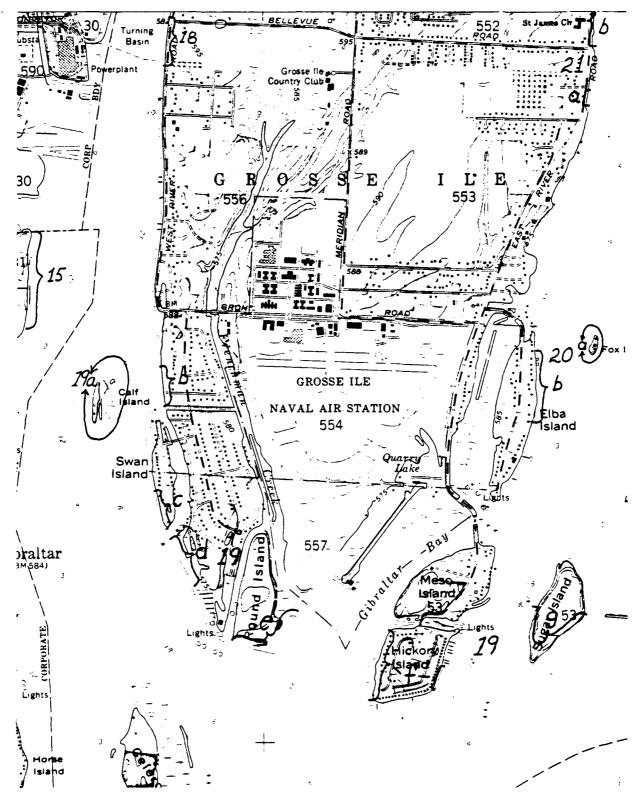


6 **&**

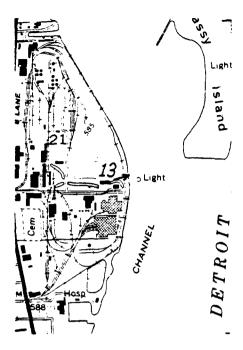
•



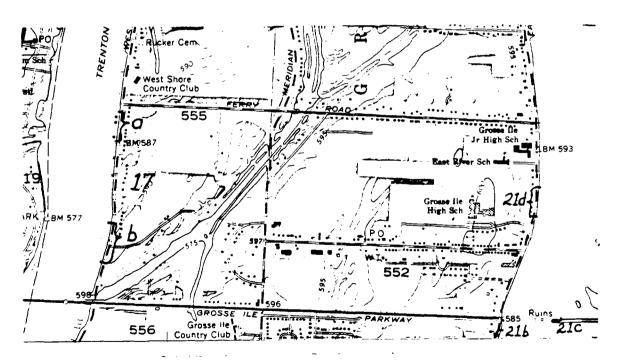
DR sites 14, 16, 21, 22 and 23 (Wyandotte, ifich., 1973).



DR sites 15, 18, 19, 20 and 21 (Rockwood, Mich., 1973).



DR site 13 (Wyandotte, Mich., 1973).

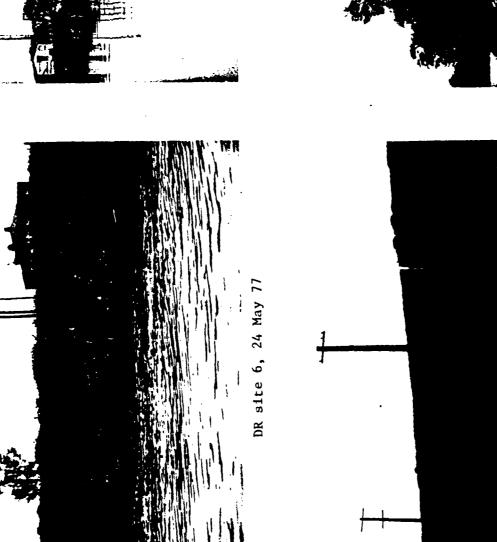


DR sites 17 and 21 (Wyandotte, Mich., 1973).

Detroit River

Selected photographs that illustrate the diversity of the eroding banks; not all eroding banks are shown.

DR site 8, 24 May 77



DR site 10, 24 May 77



DR reach 14c, 30 May 80



DR reach 16d, 24 May 77

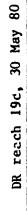


DR reach 16f, 30 May 80



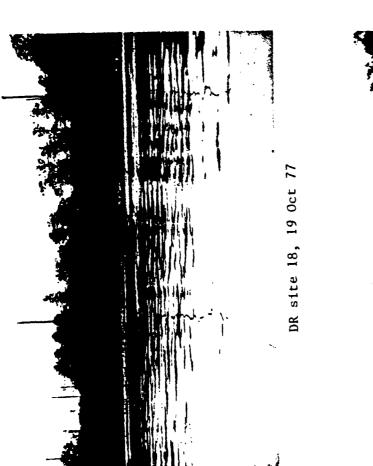
DR reach 21b, 19 Oct 77

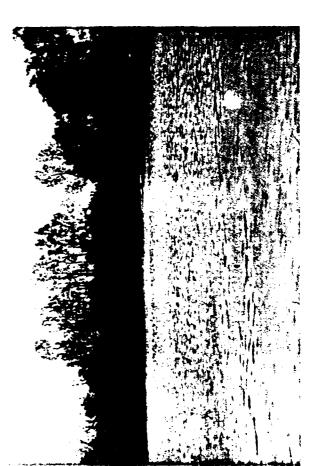




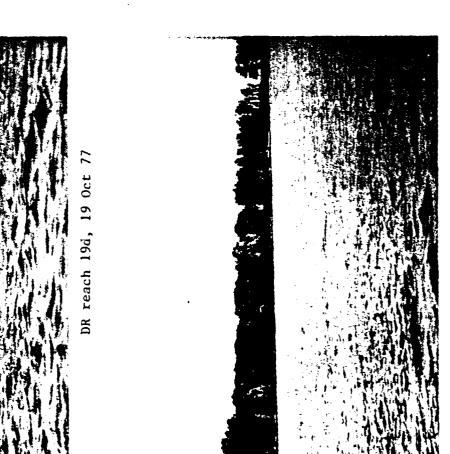


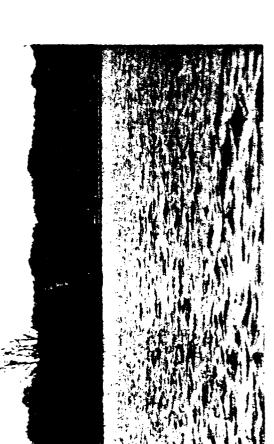
DR reach 19b, 30 May 80





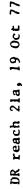
DR reach 19b, 19 Oct 77





DR reach 19e, 19 Oct 77

DR reach 19f, 30 May 80





DR reach 19g, 30 May 80



DR reach 20a, 30 May 80



DR reach 20b, 19 Oct 77



DR site 22, 24 May 77



DR reach 21d, 19 Oct 77



DR site 23, 21 May 78

Detroit River

Descriptions, photographs and generalized river cross-sections for profiled reaches, some eroding reaches and selected sites (distances in feet).

SITE NO. DR 18

Weather:

DATE

Sample taken OYes O No

						į			DR 1a
BEACH	© xYes	Orientation	IM.	Width	Texture	Remarks			
Photo No.	ê D	ENE-WSW			Gravel and sand with cobbles and boulders	Scattered co	Scattered concrete slabs riprap (Fig. D45)	rap (F1 g. D45)	
	Orientation ENE-WSW		Slope 45°-90°	Length 200	Evidence of Surface Runoff Rills Gullie	Evidence of Irigace Runoff INO Is Gullies	Evidence of Grou Staining Damp Zone	ndwater Seepag Vegetation	e finer Remarks
BLUFF									
Photo No.	Vegetation Collapsing Stabl	Stable Type X Grass	Remarks Sheet metal	t	bulkhead was built on western end	on western end			
	O Artificial (fill)	(fill) Texture	-	Color	Structures	Remarks			
3011	X2 Natural	Gravelly	y		Not observable	!			
O NEARSHORE	Shelf Steep	Bathymetry teep Shelf/Drop off		Texture	Bedforms INO	to Vegetation Type Den	ion O No Density	Remarks	
CONDITIONS	×	(Fig. D58)	Cre	Gravel	Not observable	ole			
	Residentia Sparse D Medium	sidential Medium Dense D	Sparse	Commercial Medium	al Dense	Agricultural	Recreational	None Remarks	
LANDUSE							Park		
UPSTREAM	Protective Structures B.H. RR Gab Oth	Structures Gab Other	Vegetared Bluff	Slope		Nearshore Conditions	Remarks		
CONDITIONS Photo No.	×				S1	Similar			
DOWNSTREAM	Protective Structures B.H. RR Gab Oth	Structures Gab Other	Vegetated Bluff	Slope		Nearshore Conditions	Remarks		
Photo No.	×			_	SI	Similar	Built be	Built between May 1977 and Oct. 1978	ct. 1978

REMARKS

SITE NO. DR 2a

Sample taken OYes O No

Weather:

DR 2a

Photo No D No	21.161.05	n Width	_	Texture	Remarks				
		_		Lougas dates by	Concrete	clabo ecatrored	alone wat	Concrete clabe exattered alone mater line (Fig. 168)	
Orientation	NE-SW	01-f		Sand with graves (Fig. D47)	1000	מושחם פרשוופופו	atong wat	(118: 110)	
SLUFF NE-SW	Height .5-2	Slope No distinct bluff (Fig.	Length 300	Evidence of Surface Runoff Rills Gullie	ON XX	Evidence of Groundwater Seepage Staining Damp Zone Vegetation (Croundwat (Vegetat ion Other	Remarks Clumps of fallen grass
Photo No. Collepsing	Stable Type	Remarks							
() () () () () () () () () ()	X Crass	-	Color	Structures	Remarks				
Soil, Granter Control Control	_	ğ		None observable				·	
G. NEARSHURE Shelf S.	Bathymetry Steep Shelf/Drop off (Fig. 058) X	Sand	9	Bedforms D No	Veget	Density	Remarks		
Sparse ClandusE	Residential Medium D Dense D	- S	Commercial Medium	Dense 🛮	Agricultural	Recreational Park	None	Remarks	
اف	Protective Structures H. RR Gab Other	Vegetated	Slope	-	Nearshore Conditions	Remarks			
CONDITIONS X		×		Sim	Similar	Scattered riprap	riprap		
e e	Protective Structures H. RR Cab Other	Vegetated Bluff	Slope		Nearshore Conditions	Remarks			
CONDITIONS X				Sim	Similar	Coast Gua	Coast Guard Station	T.	

REMARKS

SITE NO. DR 2h

Concrete slabs and boulders scartered along by the life of the latter of latter of the latter of lat	Sample taken O'Ves O No	D'rea C to									DR 2b	
Collapsing Stable Type Takture Shelf Steep Shelf/Drop off Fig. D58) Frotective Structures Protective Structures B.H. RR Gab Other Orientation Vegetation Vegetation Vegetation Orientation Vegetation Orientation Vegetated Structure Bedforms BNo Structures Structure Bedforms BNo Structures Shelf Steep Shelf/Drop off Spare B Hedium B Dense B Shelf Steep Shelf/Drop off Spare B Hedium B Dense B Shelf Steep Shelf Shelf Buff Spare B Hedium B Dense B Shelf Structures B.H. RR Gab Other Bluff Similar, b Similar, b Similar	BEACH	O Yes	Orientation	PIA	41	Texture	Remarks					
Collapsing Stable Type Remarks Collapsing Stable Type Remarks Collapsing Stable Type Host of reach has no distinct bluff Remarks Collapsing Stable Type Collapsing Stable Type Collapsing Stable Type Collapsing Shelf Drop off Texture Collapsing Shelf Stable Type Collapsing Shelf Shelf Stable Type Collapsing Shelf Stable Type Stable Type Collapsing Shelf Sh	.hoto No.	<u>\$</u>	3* **	3-15		ravelly sand	Concrete slabs line; grass gro	and boulders swing on beach	cattered (Fig. D49	along beach near th	ne water-	
Collapsing Stable Type Most of reach has no distinct bluff Antificial (fill) Texture Collapsing Stable Type Most of reach has no distinct bluff Antificial (fill) Texture Color Structures Bathymetry (Fig. D58) None observable Shall Steep Shelf/Drop off Residential Sparse Hedium Dense D Protective Structures B.H. RR Gab Other Buff Similar, but shelf not as Protective Structures B.H. RR Gab Other Buff Similar Similar Similar Similar Similar		Orientation	Height	Slope	Length	Eviden	e Z	Evidence of C	roundwat	etation Other	Remarks	
Collapsing Stable Type Most of reach has no distinct bluff Elatificial (fill) Sand Tan None observable Residential Sparse Hodium Dense Sparse Bluff Similar Residential Sparse Hodium Dense Bluff Similar Residential Sparse Hodium Dense Meirshore Conditions Similar Residential Sparse Hodium Dense Meirshore Conditions Remarks Residential Sparse Hodium More observable Meirshore Conditions Remarks Residential Sparse Meirshore Conditions Remarks Remarks Similar None Newrable Newrable Remarks Similar Similar Similar Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remarks Remar	BLUFF	3 	C.	(!	700							
Collapsing Stable Type Most of reach has no distinct bluff Elatificial (fill) Texture Color Shelf Steep Shelf Drop off Sparse B Medium Dense Sparse B Medium Dense Frotective Structures B.H. RR Gab Other Residential Sparse B Medium B Most observable Frotective Structures B.H. RR Gab Other Residential Sparse B Medium B Most observable Similar, but shelf not as wide Nenatks Similar Similar Similar Kemarks	Photo No.	<u> </u>		Remarks								
Texture Golor Structures Remarks Shelf Steep Shelf/Drop off Sand Tan None observable Residential Sparse Hedium Dense D					reach has	no distinct bl	uff					
Shelf Steep Shelf/Drop off Sand Not observable Residential Sparse Hedium Dense Sparse Hedium Dense Sparse Densette Bluff Similar, but shelf not as bluff Structures Bluff Similar Residential Sparse Dense	1103		_	_	olor	Structures	Remarks)
Shelf Steep Shelf/Drop off (Fig. D58) X Residential Sparse E Hedium Dense Dense Dense Dense Density Residential Sparse E Hedium Dense Dense Density Residential But Residential Recreational None Protective Structures Remarks Nemarks Nemarks Nemarks Remarks Similar Neurshore Conditions Remarks	1106	Matural Natural	Sand			one observable						
Residential Sparse Sand Not observable Recreational None	300m3d 4 Sm	ľ	¥	-	ture	l	Veget	i El No	Remarks			
Sparse Hedium Dense Sparse Hedium Dense Protective Structures Bluff Similar, but shelf not as Protective Structures Wegetated Slope Nearshore Conditions Remarks Protective Structures Wegetated Slope Nearshore Conditions Remarks Protective Structures Wegetated Slope Nearshore Conditions Remarks Bluff Similar Similar Similar Similar Similar Similar Similar Similar Similar Simi	CONDITIONS					tot observable		1				
Protective Structures Vegetated Slope Nearshore Conditions B.H. RR Gab Other Bluff Similar, but shelf not as wide Protective Structures Vegetated Slope Nearshore Conditions B.H. RR Gab Other Bluff Slope Nearshore Conditions Similar		lõi		Sparse	යි	l	-	lecreational	None	Remarks		
Protective Structures Vegetated Slope Nearshore Conditions S. X. X. Cab Other Bluff Singlar, but shelf not as wide Protective Structures Vegetated Slope Nearshore Conditions M. B. H. RR Gab Other Bluff Singlar	LANDUSE							Park				
Similar, but shelf not as wide wide Protective Structures Vegetated Slope Nearshore Conditions Billi RR Gab Other Bluff Similar		Protective	Structures	Vegetated	Slo	_	hore Conditions	Remarks				
Protective Structures Vegetated Slope Nearshore Conditions M B.H. RR Gab Other Bluff Similar	UPSTREAM CONDITIO.S	ž!		11016		Similar	, but shelf not as					
X	MUNCTOR.	Protective	Structures	Vegetated	Slo	_	hore Conditions	Remarks				
	CONDITIONS Photo No	×				Si	nilar					

REMARKS

Sample taken DYes G No

Weather:

Sample taken Dies D No	OYes O No							DR 16a
BEACH	Qx Yes	Orientation	Width	£1	Texture	Remarks Trees, brush	n and grass clump	Remarks Trees, brush and grass clumps near toe of bluff
thoto No.	2 0	NNE-SSW	£	Grav	Gravelly sand			
	Orientation NNW-SSW	Height S 10-15 50°-	Slope 50°90°	Length 800	Surface Runoff	£ 1	Staining Damp Zone	Evidence of Groundwater Seepage XQ No Remarks
BLUFF					N X			
Photo No.	힐		Remarks				99 11 044 90 000	I and the state of
	X	Grass/trees	During most of into river; tre	st of the su	urveys, warerii ots exposed al	During most of the surveys, waterline was at the base of into river; trees roots exposed along bluff (Fig. D50)	. DSO)	the surveys,waterine was at the base of the bluit, several trees were trady to fair ses roots exposed along bluff (Fig. D50)
	DArtificial (fill)	(fill) Texture	-	Color St	Structures	Remarks		
SOIL	A Natural	sandy and gravelly clay	clay Tan	•	Weak layering		•	
A SOUTH OR A MAN	Shalf Steep	Bathymetry teen Shelf/Drop off	一	<u> </u>	Bedforms 5 No	Vegetat	1on KNo Density	Remarks
S CONDITIONS	_		sand gravel		Not observable			
	1.91	-1		Commercial		Agricultural	Recreational	None Remarks
LANDUSE	Sparse D Hed	Medium Dense D	Sparse	Med I um	Dense D			X Bluff borders a road
	20	structures	Vegetated	Slope	-	Nearshore Conditions	Remarks	
UPSTREAM CONDITIONS	B.H.	Gab Other	a land		SIS	Similar	Riprap sca	Riprap scattered and of variable type
THE MAN	otective		Vegetated	Slope	-	Nearshore Conditions	Remarks	
CONDITIONS Photo No.	ж. х х	ORD			Similar	Similar (Fig. D51)	Scattered	Scattered and variable

REMARKS Figure D52 shows typical shoreline along site 16.

DATE Sample taken OYes O No SITE NO. DR 16f

Weather:

Sample taken	OYCS ONO							DR 16f
BEACH	D Yes	Orientation	3	Width	Texture	Remarks		-
						Waterline at	base of bluff o	Waterline at base of bluff on south end of reach (Fig. D53); concrete
boto No.	£ 0	N-S	0-5		Sandy gravel	slabs are sc	slabs are scattered along the beach	beach
	Orientation	Height	Slope	Length	Evidence of	i	Evidence of	indwater Seepage
					3Ce	tunof f	Staining Damp Zone	Vegetat Ion Other
	S-N	1-1-6	*0605	400	Rills	Cullies		end; being
BLUFF								South end (Fig. D54)
Photo No.	Vegetation	at 10n	Remarks					
	Collapsing	Stable Type	Man-mad	e changes he	ere may be more	a important tha	t natural change	Man-made changes here may be more important that natural changes; there are numerous trails up and!
	×	Grass	down the	bluff alon	down the bluff along this reach	!		
	DArtificial (fill)		ire ire	Color	Structures	Remarks		
SOIL		Sandy and	_	_				
	ENatura!	gravely clay		Tan-gre.	Layered			
	Bat	hvmetry	1,1	9	Bedforms D No	_	fon My	Remarks
NEARSHORE	Shelf Stee	Steep Shelf/Drop off		ر کار در از		Type Dens		011 saturates the clay further off-
CONDITIONS	_	D59) X	cohesive	cohesive ciay	Not observable	e e		shore along the shelf
	Regid	Residential		Commercial	1	Agricultural	Recreational	None Remarks
	Sparse D Me	Hedium [] Dense []	Sparse		Dense 🗖			
LANDUSE							Park	
	Protective Structures	Structures	Vegetated	Slope	-	Nearshore Conditions	Remarks	
UPSTREAM	B. H.	Cab Other	Bluff	-				
Phoro No.	×				St	Similar	Shelf narrower	rower
	Protective Structures	Structures	Vegetate	Slope	_	Nearshore Conditions	Remarks	
DOWNSTREAM	B. II.	Cab Other	Bluff					
CONDITIONS Photo No	×				Sto	Similar	Shelf narrower	rower

REMARKS

DATE SITE NO. DR 18

Sample taken OYes D No

Weather:

DR 18 (north)

	1							מע זמ לוומנינון	(more that
BRACH	D X Yes	Orientation	-	Width	Texture	Remarks			
Photo No.	<i>≨</i>	S-N	<u> </u>	0-15	Sand with cobbles and boulders	es Grass growing on at the waterline	ig on beach and deb line (Fig. D55)	ebris and sca	Grass growing on beach and debris and scattered concrete slabs at the waterline (Fig. D5)
	Orientation	2	Slope	Length	-	Evidence of Surface Runoff XI No	Staining Damp Zone	121	Nater Seepage MB No Remarks
BLUFF	S - Z	5-15	°06~_05	000	RILIS	Gullies			
Photo No.	Vegetation Collapsing Stabl	ation Stable Type	Remarks Bluff sl	ope 1s	ess and much of	bluff is vegeta	ted on north end	of site. No	less and much of bluff is vegetated on north end of site. North end looks more stable.
	×	Grass/trees	_) 			
	DArcificial (fill)	_	Texture	Color	Structures	Remarks			
3015	E Natural	Sandy clay	clay	Tan	Layering	Sandy 6	Sandy gravel layers		
NEARSHORE CONDITIONS	Shelf Steep	Bathymetry teep Shelf/Drop off		Texture sandygravel on top of	Bedforms GNo	F 5	Vegetation D No Ype Density asses Sparse	Remarks Very soft bo shore	Remarks Very soft bottom approximately 10 ft off- shore
	Residential	tial	c1ay.	y Commercial	clal	Agricultural	Recreational	None	Remarks
99 LANDUSE	Sparse D Med	Medium () Dense ()	Sparsed	١.	Med tum [] Dense []			×	Borders a road

Rest of Site 18 has scattered bluffs, few trees sliding into water (Fig. D57). REMARKS

Scattered riprap

Remarks

Mearshore Conditions

Slope

Vegetated

B.H. RR Gab Other

DOWNSTREAM CONDITIONS Photo No.

Similar

Variable (Fig. D56)

Remarks

Nearshore Conditions

Slope

Vegetated Bluff

B.H. RR Gab Other

UPSTREAM Photo No.



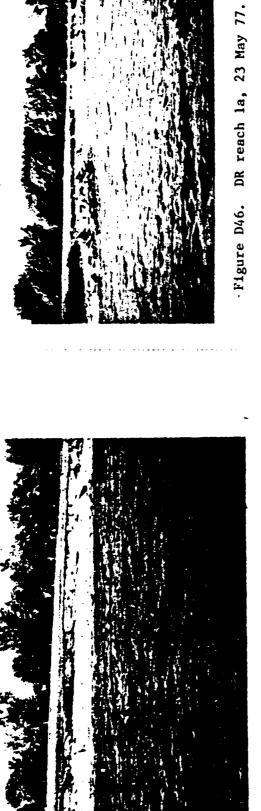
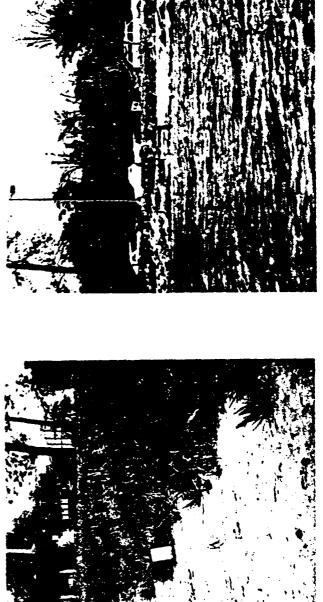


Figure D45. DR reach la, 30 Oct 78.



DR reach 2a, 20 May 79. Figure D47.

Figure D48. DR reach 2a, 30 Oct 78.



Figure D50. DR reach 16a, 21 May 78.



Figure D49. DR reach 2b, 30 Oct 78.

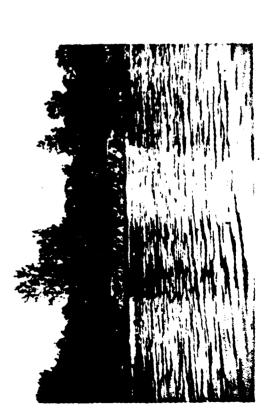


Figure D51. DR reach 17a, 24 May 77.



Figure 052. DR reach 16a, 24 Hay 77.



Figure D53. DR reach 16f, 21 May 78.



Figure D54. DR reach 16f, north end, 20 May 79.



Figure D55. DR reach 18, north end, 20 Hay 79.

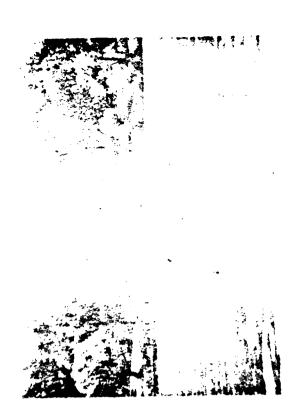
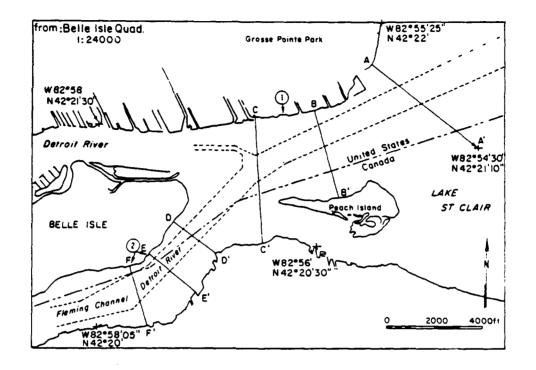


Figure D56. DR reach 18, south end, 24 Hay 77.



Figure D57. DR reach 18, south end, 21 May 78.



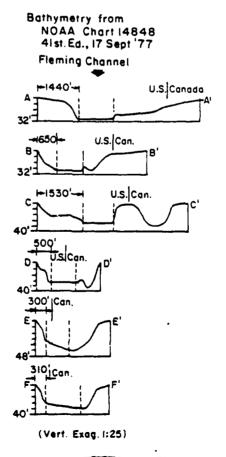


Figure D58. Generalized river cross-sections, sites 1 and 2, Detroit River.

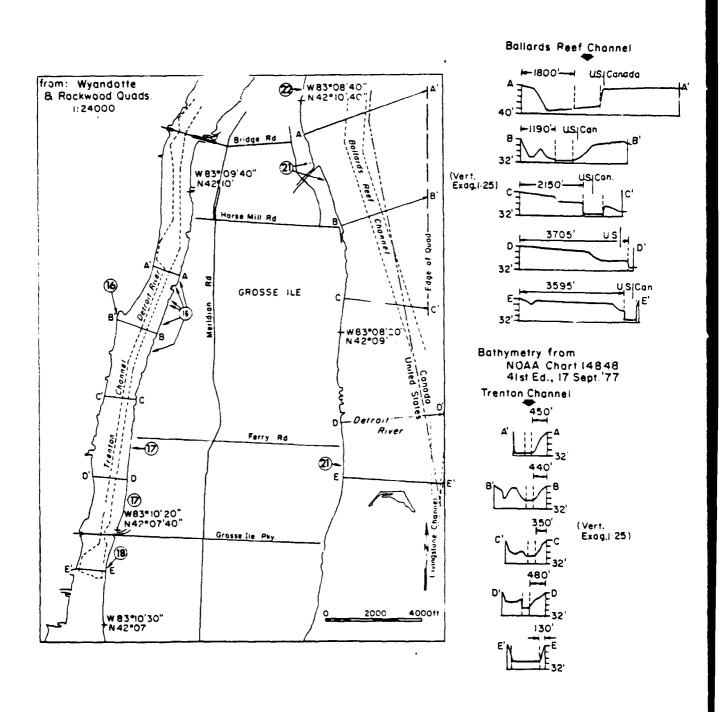


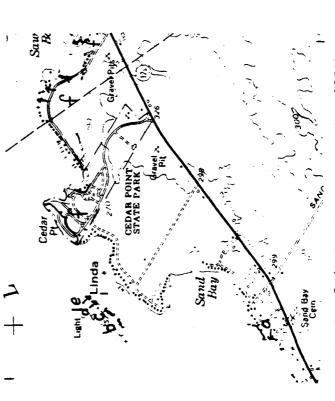
Figure D59. Generalized river cross-sections, sites 16, 17, 18, 21, 22 and 23, Detroit River.

St. Lawrence River

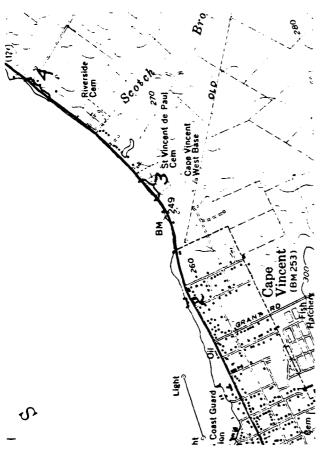
Locations of partially vegetated and bare banks (shown on portions of U.S.G.S. 7-1/2 minute-series topographic maps).



SLR site 1 (Cape Vincent South, N.Y., 1958).



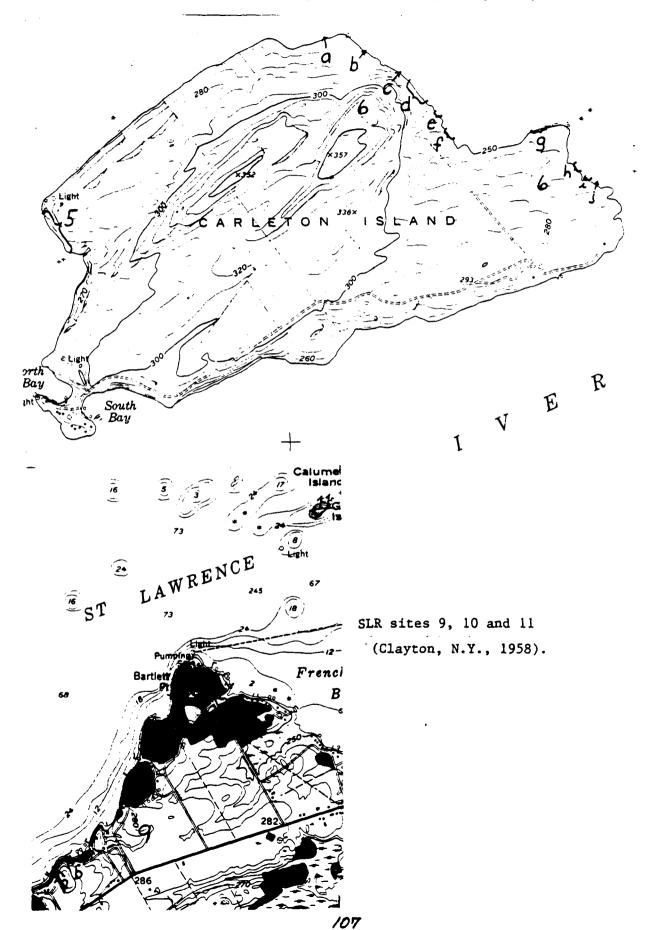
SLR site 7 (Saint Lawrence, N.Y., 1958).

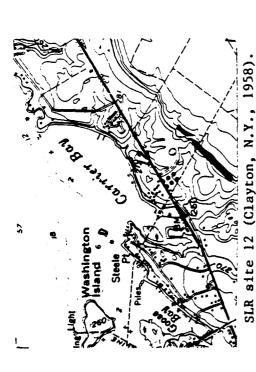


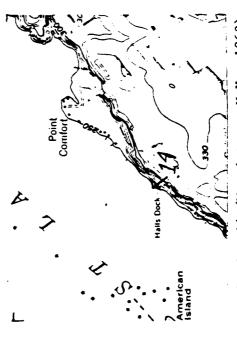
SLR sites 2, 3 and 4 (Cape Vincent North, N.Y., 1958).



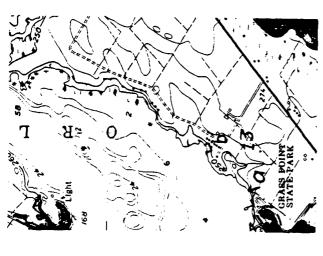
SLR site 8 (Saint Lawrence, N.Y., 1958).



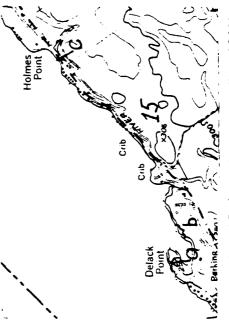




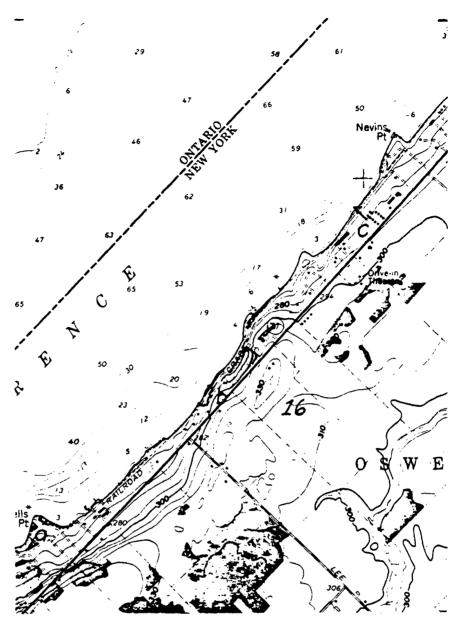
SLR site 14 (Morristown, N.Y., 1963)



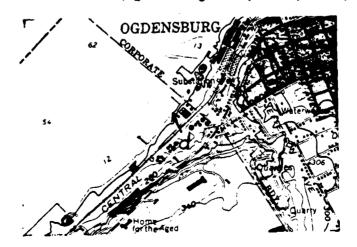
SLR site 13 (Alexandria Bay, N.Y., 1958).

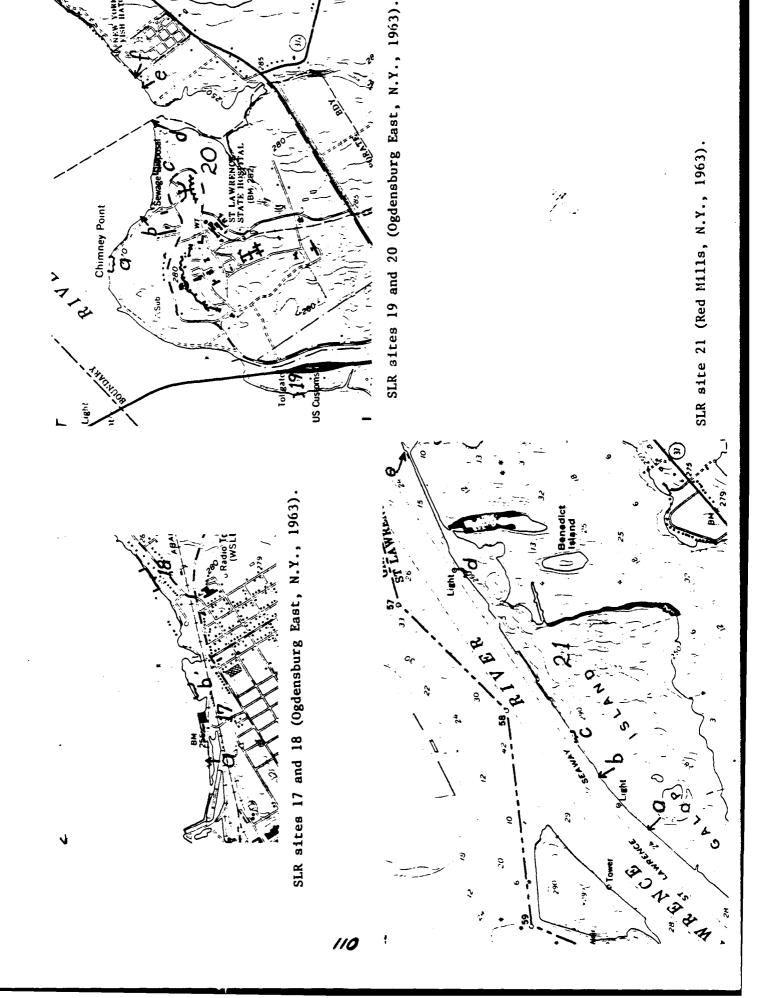


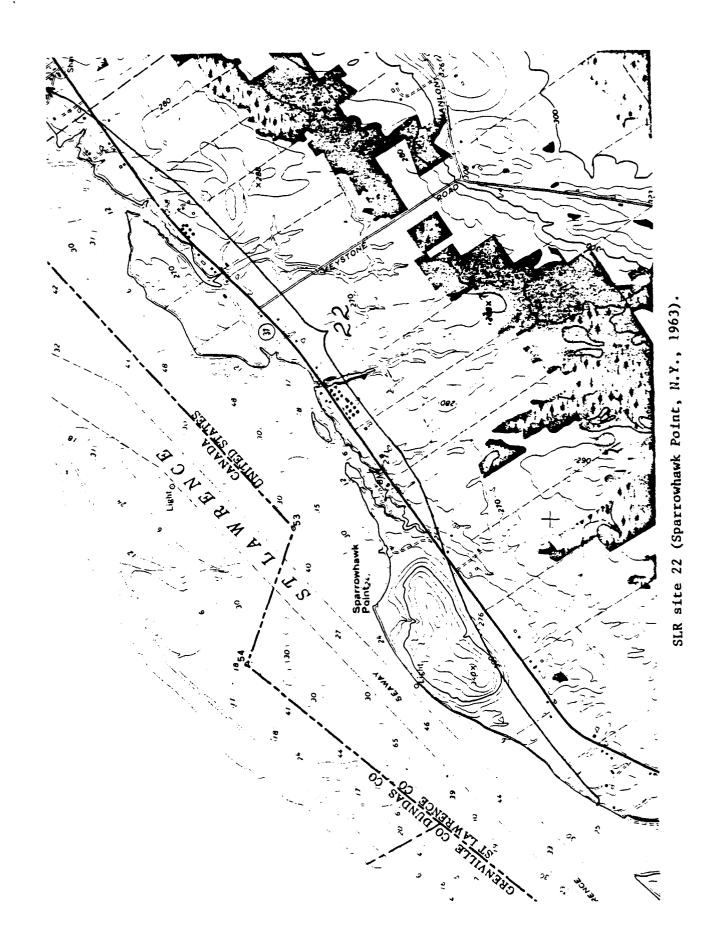
SLR site 15 (Morristown, N.Y., 1963).



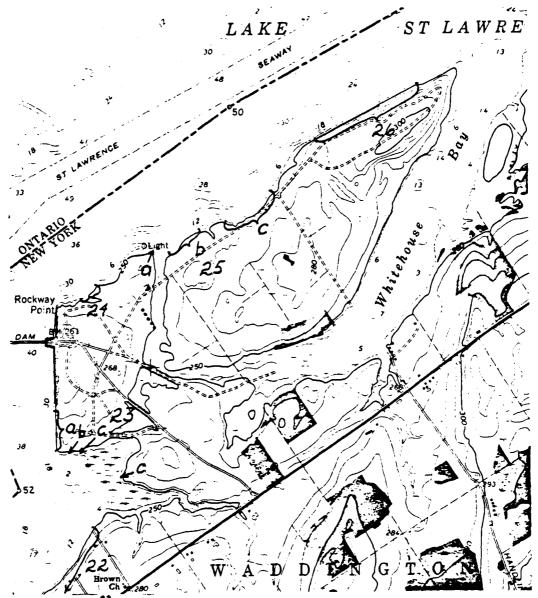
SLR site 16 (Ogdensburg West, N.Y., 1963).



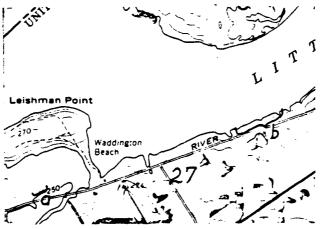




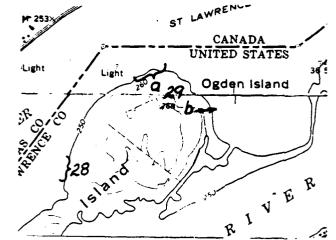
///



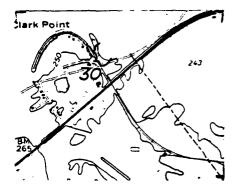
SLR sites 23, 24, 25 and 26 (Sparrowhawk Point, N.Y., 1963).



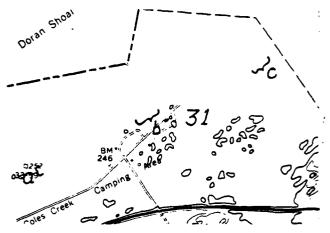
SLR site 27 (Waddington, N.Y., 1964).



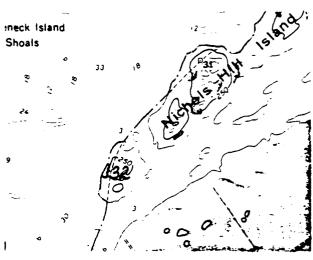
SLR sites 28 and 29 (Waddington, N.Y., 1964, and Morrisburg, Ont., 1964).



SLR site 30 (Waddington, N.Y., 1964).



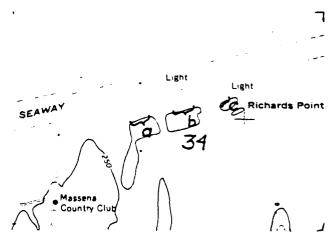
SLR site 31 (Morrisburg, Ont., 1964).



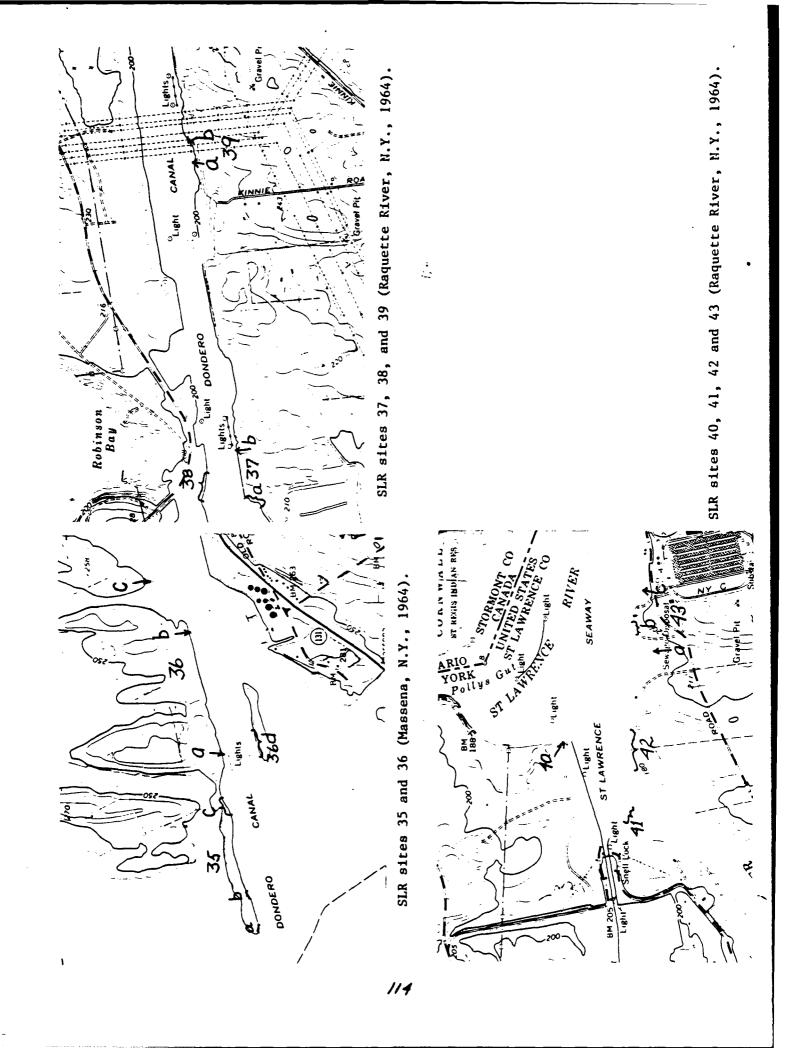
SLR site 32 (Louisville, N.Y., 1964).

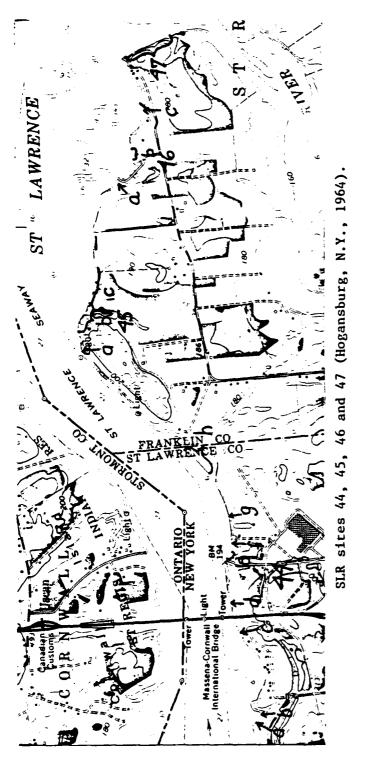


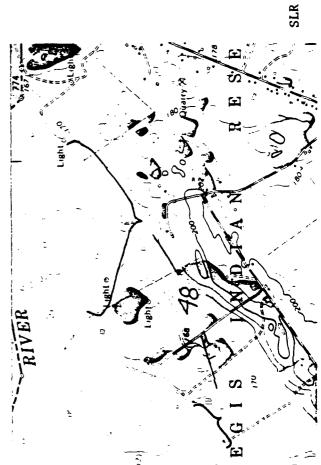
SLR site 33 (Lousiville, N.Y., 1964).



SLR site 34 (Massena, N.Y., 1964).







SLR site 48 (Hogansburg, N.Y., 1964).

St. Lawrence River

Selected photographs that illustrate the diversity of the eroding banks; not all eroding banks are shown.



SLR reach 6f, 13 May 78



SLR reach 6f, 18 May 78



117



SLR site 12, 18 May 78



SLR site 12, 18 May 78

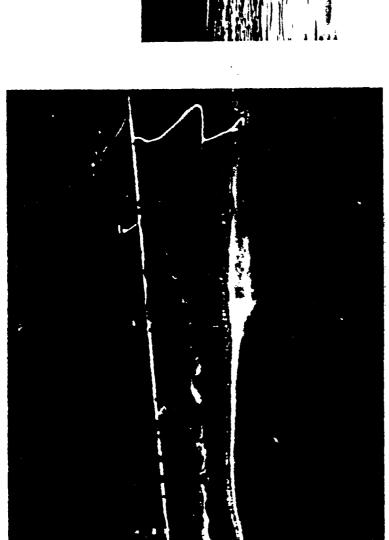


SLR reach 20e, 16 Nov 77

SLR reach 20f, 28 May 78



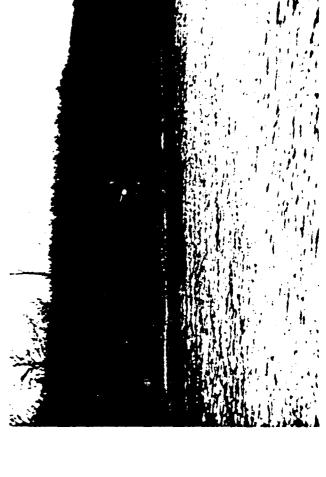
118



SLR site 22

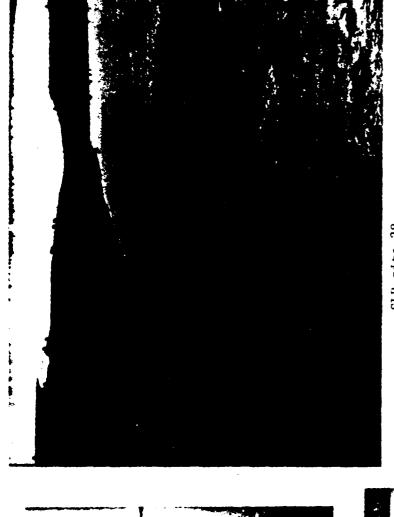


SLR site 22, 17 May 78



SLR reach 25c, 28 Oct 78

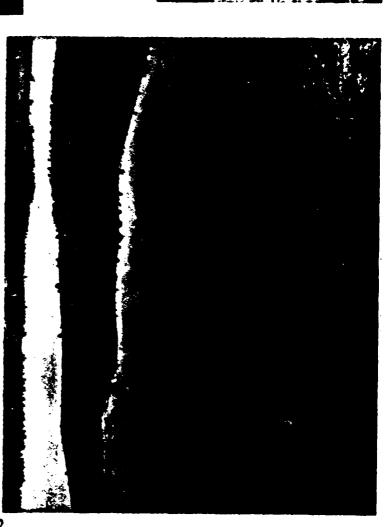
SLR site 22, 17 May 78

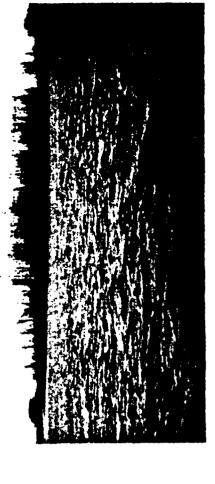


SLR site 28



SLR site 26, 17 Hay 78





SLR reach 34b, 27 Oct 78

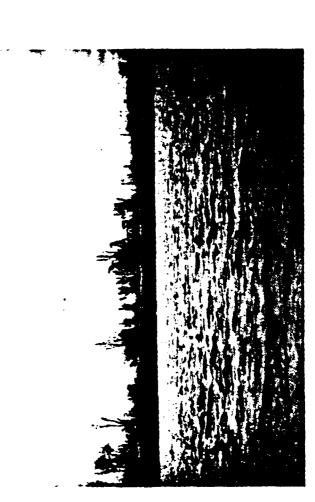


SLR reach 34a, 27 Oct 7



SLR reach 35c, 18 Eay 78

SLR site 41, 16 May 78

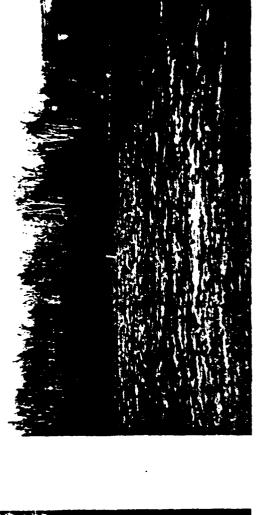


SLR reach 36b, 27 Oct 78



SLR site 42, 16 Hay 78

SLR site 41, 17 Nov 77



SLR reach 44d, 27 Oct 78



SLR site 42, 16 May 78



SLR reach 45b, 27 Oct 78



SLR site 48, 17 Nov 77

St. Lawrence River

Descriptions, photographs and generalized river cross-sections for profiled reaches, some eroding reaches and selected sites (distances in feet).

SITE NO. SLR 20a

Weather:

Sample taken (1) Yes (2) No

									SLR 20a	
BEACH	O Yes	Orientation	3	Width	Texture	Remarks			-	
of the Man		2	ć		Sandy gravel,	-				
LINGTO MO.	2	R L	3		d boulders (F)	(p D60)				
	Or lentation	Height	Slope	Length	Evidence of	nce of Ro No	Statutus Damp Zone Vesetation	Croundwater	XX No	Remarks
BLUFF	3-3 3-	.5-2	4590.	300	RIIIs Gullier	en t				no distinct bluff (Fig. D61)
, O4040	10000		Possette							
- R 0001	Collapsing Stabl	Stable Type Grass								
	O Artificial (fill)	fill) Texture	-	Color	Structures	Remarks				
S01L	E Netural	Grave	Gravelly sand	Tan	Not observable					
		Bathymetry	-	Texture	Bedforms B No	No Vegetation	tion You No	Remarks		
CONDITIONS	Shelf Steep	Shelf/Drop off	مَدِي	ravel, cobbl's,		Туре	Density	High	High water velocities	
		9/1)	- - -		-	April 1000	Doctoot tonal	None	Domorto	
	Clerkban 13 serson	Med fue Ca Dense Ca	Sparge	Modition	To do lo	DE TENTENT	WCC1 COCTOURS			
LANDUSE	200		×	-,					State Hospital property	perty
HPCTBKAM	Protective Structures	Structures Cab Orber	Vegetated	Slope	_	Nearshore Conditions	s Remarks			
CONDITIONS Photo No.	[]		×			Similar				
	Protective Structures	tructures	Vegetated	Slope	L	Nearshore Conditions	Remarks			
DOWNSTREAM	B.H. RR Ca	Cab Other	Bluff							
Photo No.			×			Similar				

REMARKS

SITE NO. SLR 26 DATE

Sample taken Dyes O No

Weather:

SLR 26

Remarks Rills nd gullies es-ecially on the est end of the fact of the bluff has more vegetation on the west end of the site; cows graze and climb up and Lower part of soil horizon is a grey-brown, silty clay till X D No Evidence of Groundwater Seepage XE Staining Damp Zone Vegetation Other Remarks None Remarks Remarks Recreational Vegetation FR No Type Density Nearshore Conditions Nearshore Conditions °N D Agricultural Remarks Similar Similar Remarks × Gullles Surface Runoff Rills Gullle Evidence of NA Texture Gravel, cobbles, and boulders down banks causing some erosion Dense 🛮 Structures Bedforms Layered (F18. D62) Commercial Medium Slope Slope Length Silty sand with Dark broun gravel and ppper and lt. upper and lt. brown lover 2400 Gravel, cobbl and boulders Texture. Width Sparsed Vegetated Vegetated 0-15 Remarks × 45°-70 Slope Bathymetry Ateep Shelf/Drop off cobbles Dense Orientation Grass Type B.H. RR Gab Other Protective Structures B.H. RR Gab Other Height 1-10 NE-SW Vegetation Collapsing Stable Residential Sparse | Medium | X (FIg. D63) O Artificial (fill) (F1g. D73) Steep Orientation O Yes DNatural ... 2 D Shelf DOWNSTREAM CONDITIONS Photo No. S NEARSHORE CONDITIONS CONDITIONS Photo No. Photo No. Photo No. UPSTREAM LANDUSE BEACH BLUFF

REMARKS

SITE NO. SLR 31b

Sample taken O'Yes O No

DATE

Weather:

SLR 31b

Remarks In any places, no istinct bluff Fig. D64) Evidence of Groundwater Seepage No Staining Damp Zone Vegetation Other Clumps of grass collapse after water undercuts the soil (Fig. D65) ON CO Remarks Remarks Evidence of Surface Runoff Rills Gullies Fine sand (Fig. Structures Texture **मु** Length 200 Solor Width 9-15 Remarks 45.-90 Slope Texture Orientation Grass 17.Pe Height 1-3 NE-SW Vegetation Collapsing Stable O Artificial (fill) Orientation Q Yes e D NE-SW Photo No. Photo No. BEACH BLUFF S011.

Coles Creek State Park

Remarks

Nearshore Conditions

Similar

Grass

Similar

Grass

Slope

Vegetated Bluff

Protective Structures B.H. RR Gab Other

DOWNSTREAM CONDITIONS

Photo No.

CONDITIONS

UPSTREAM

LANDUSE

Photo No.

Remarks

Nearshore Conditions

Slope

Vegetated

Protective Structures B.H. RR Gab Other

Park

Remarks

None

Recreational

Agricultural

Dense 🗖

Med i um 🖸

Sparsed

Dense D

Sparse D Medium D

Commercial

Ripples

Sand

Remarks

Vegetation H No

Bedforms S No

Texture

Bathymetry steep Shelf/Drop off

Steep

Shelf

MEARSHORE CONDITIONS

(F18. D74) | X

Layered

Tan

Sand

(D)Natura)

REMARKS

Staining Damp Zone Vegetation Other Clay appears to "flow" out onto beach (Fig. D69) Remarks Remarks None Grass clumps along face and at toe of bluff (Figs. D66 and D67) Recreational Vegetation XII No Type Density No. Agricultural Remarks Surface Runoff Rills Gullies Evidence of Texture Cravelly sand with cobbles (Fig. D66) Bedforms KNO Clay is layered (Fig. D68) Structures Sparse Nedlum C Length 8 Brown to Gravel and cobbles Color Texture HIGGI 0-10 Brey Remarks 45.-90 Slope Silt or clay Texture Bathymetry Steep Shelf/Drop off Orientation Type Grass Height 3-6 E-W Residential Vegetation Collapsing Stable O Artificial (fill) (Fig. D76) Orientation SAN Matural O Yes 운 **D** E-W Shelf E NEARSHORE CONDITIONS Photo No. Photo No BLUFF BEACH 301L

Remarks

SLR 38

Weather:

DATE

Sample taken OYes O No

SITE NO. SLR 38

REMARKS

Grass-covered bluff looks stable; grassy plain

Grass plain in backshore

Remarks

Nearshore Conditions

Slope

Vegetated Bluff X

B.H. RR Gab Other

UPSTREAM Photo No.

LANDUSE

Park

Dense 🛮

Dense

Remarks

Nearshore Conditions

Slope

Vegetated Bluff X

Protective Structures B.H. RR Gab Other

DOWNSTREAM CONDITIONS

Photo No.

Similar

Similar

Robert Moses State Park



Figure D60. SLR reach 20a, 23 Oct 78.

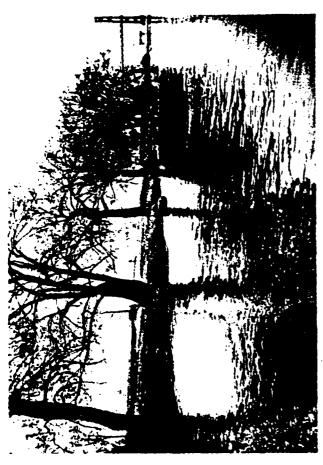


Figure D61. SLR reach 20a, 18 May 78.



Figure D62: SLR reach 26, 17 May 78.



Figure D63. SLR reach 26, 17 May 78.



Figure D64. SLR reach 31b, 17 May 78.





Figure D66. SLR reach 38, 16 May 78.



Figure D67. SLR reach 38, 1 Oct 79.

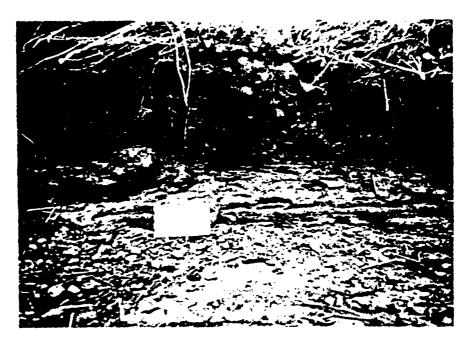


Figure D68. SLR reach 38, 1 Oct 79.

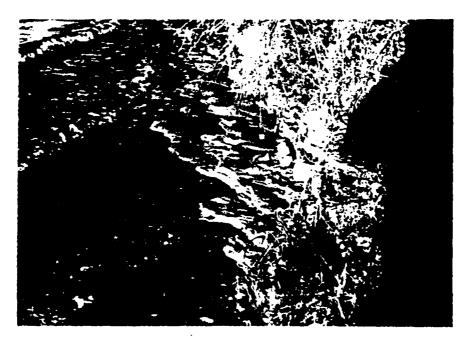
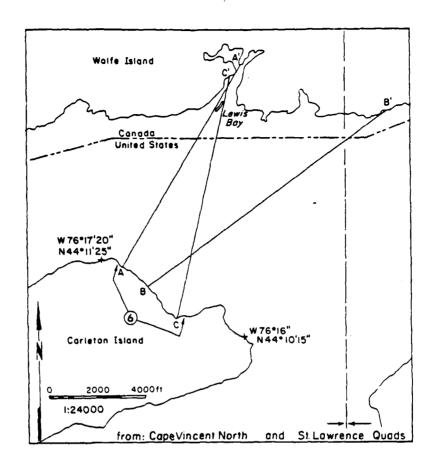


Figure D69. SLR reach 38, 27 Oct 78.



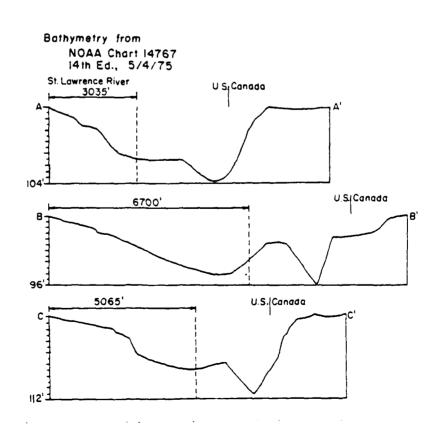
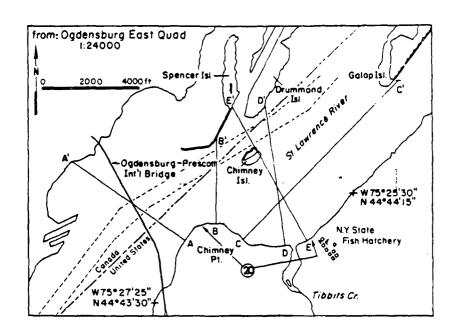


Figure D70. Generalized river cross-sections, site 6, St. Lawrence River.



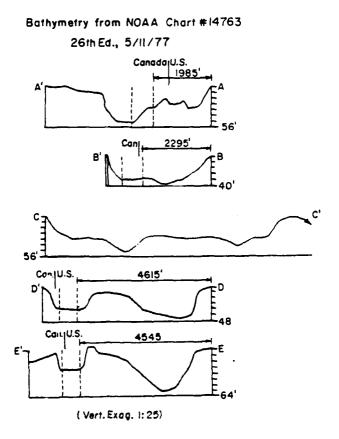
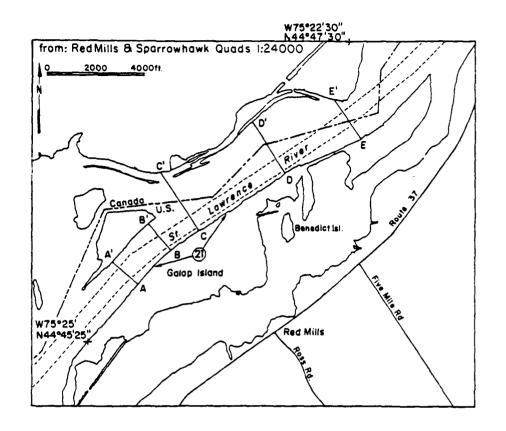


Figure D71. Generalized river cross-sections, site 20, St. Lawrence River.



Bathymetry from NOAA Chart #14763 26th Ed., 5/11/77

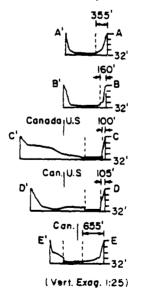
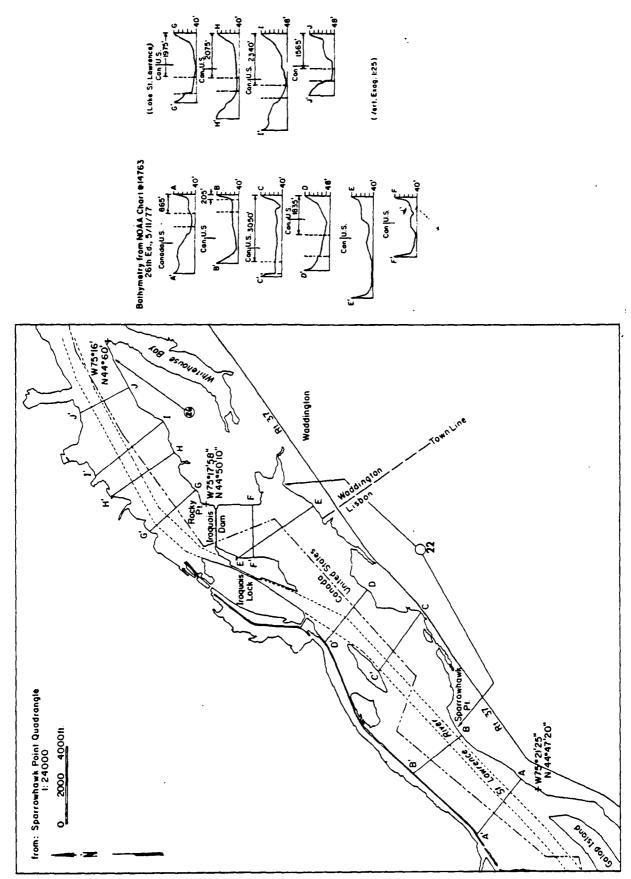
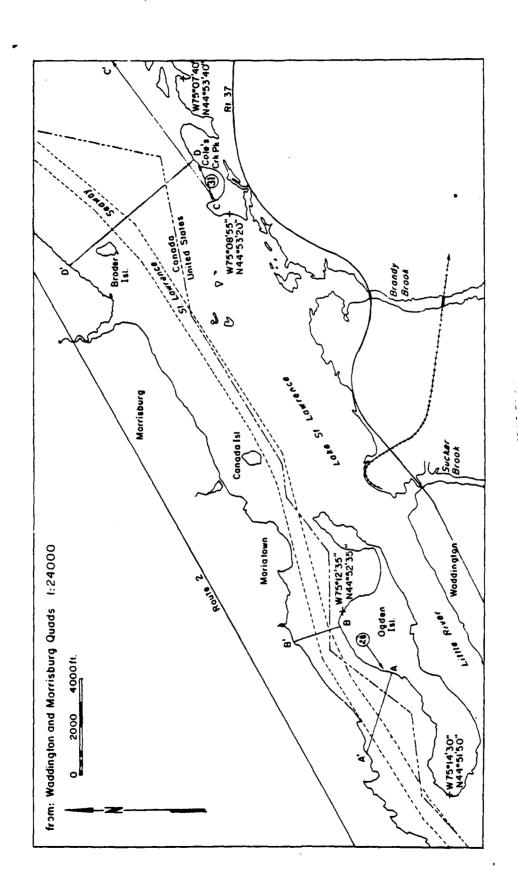


Figure D72. Generalized river cross-sections, site 21, St. Lawrence River.



Generalized river cross-sections, sites 22 to 26, St. Lawrence River. Figure D73.



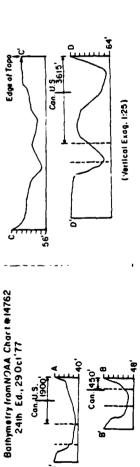
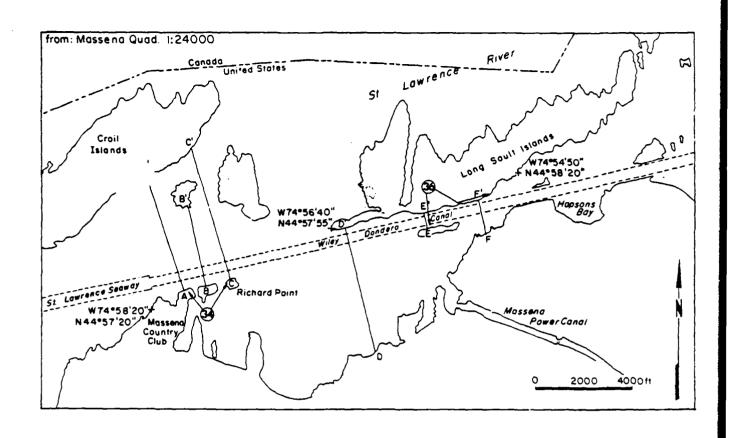
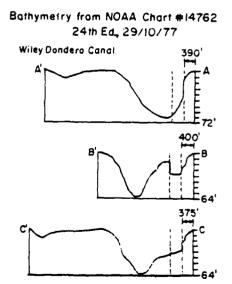


Figure D74. Generalized river cross-sections, sites 28 to 31, St.





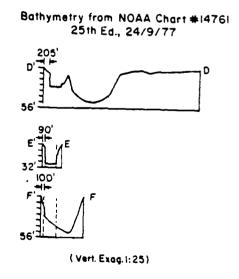
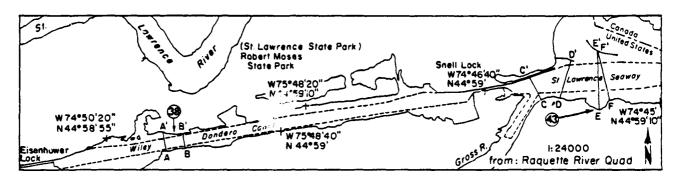
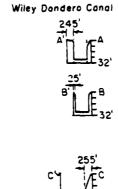


Figure D75. Generalized river cross-sections, sites 34 to 36, St. Lawrence River.



0 2000 4000ft.

Bathymetry from NOAA Chart#14761 25th Ed., 24 Sept. '77



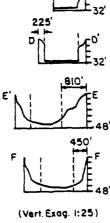
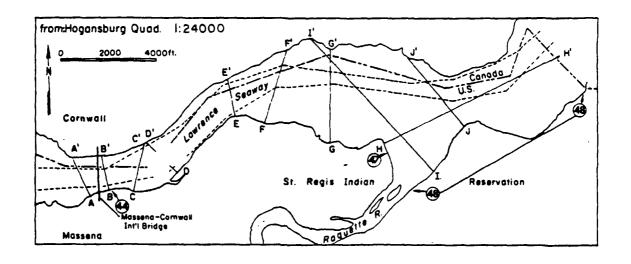
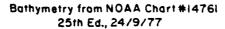


Figure D76. Generalized river cross-sections, sites 38 to 43, St. Lawrence River.





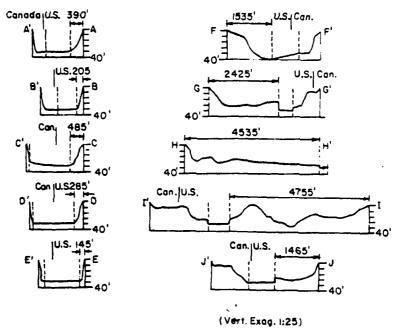


Figure D77. Generalized river cross-sections, sites 44 to 48, St. Lawrence River.